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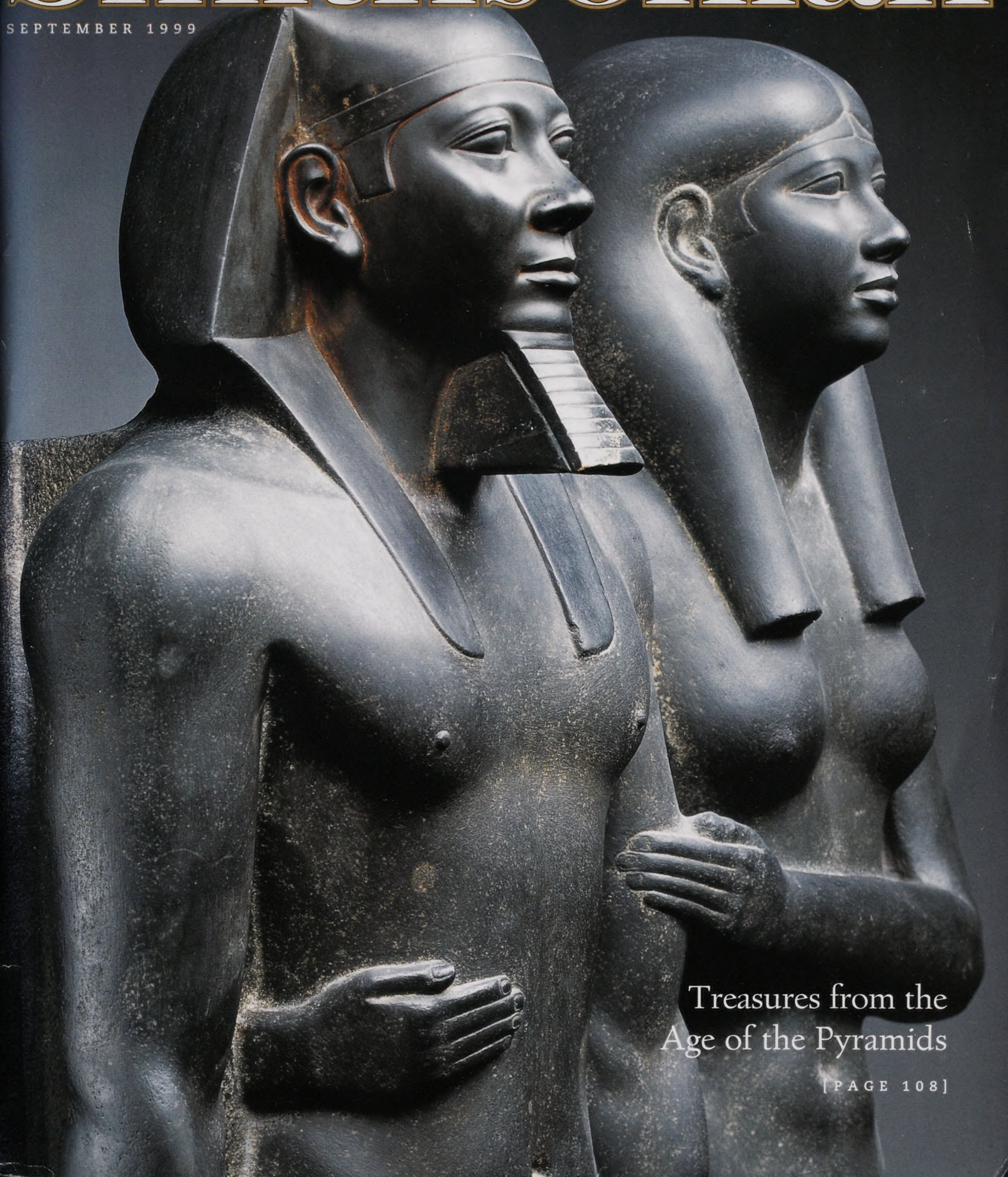

Treasures from the Age of the Pyramids

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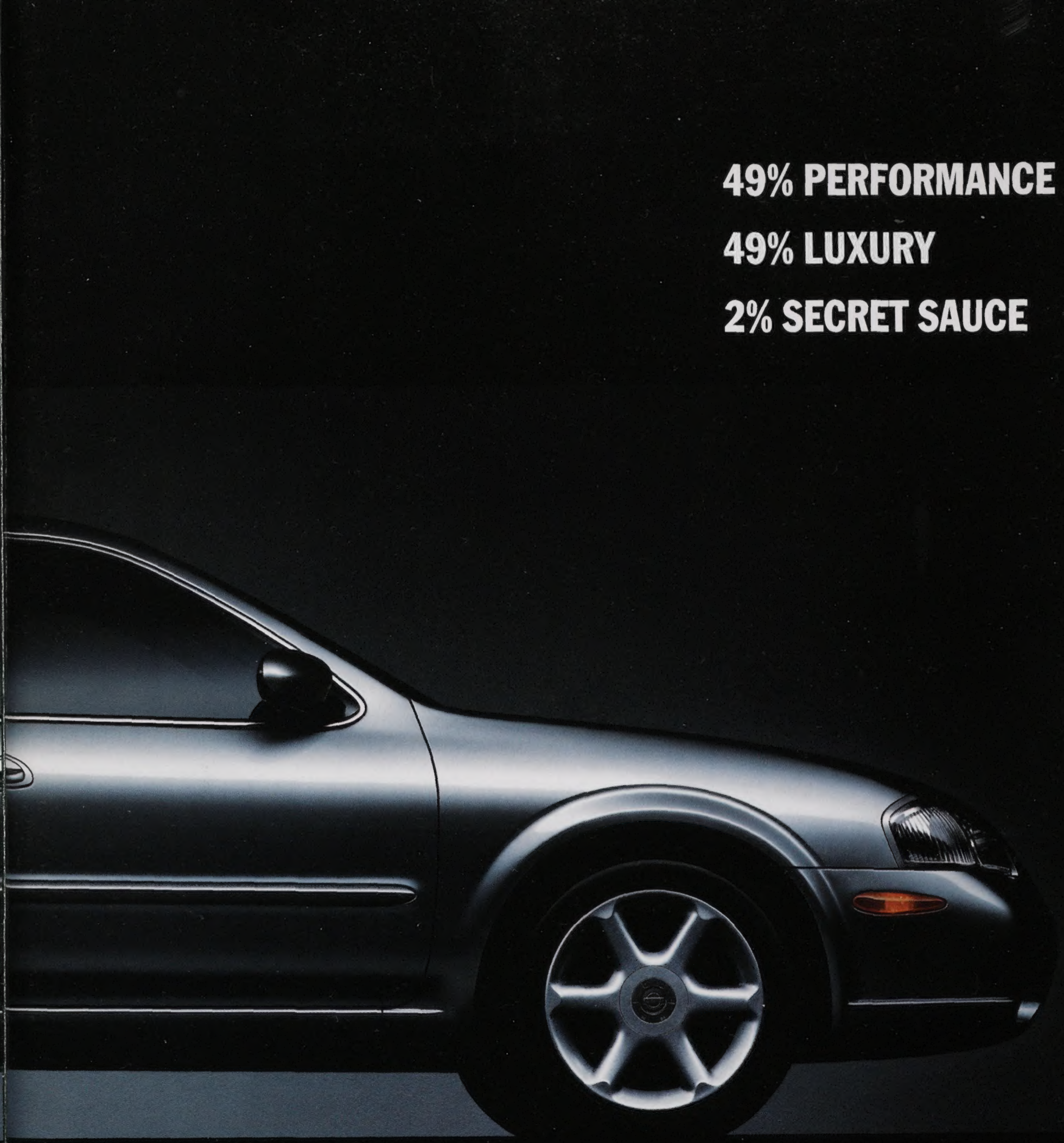

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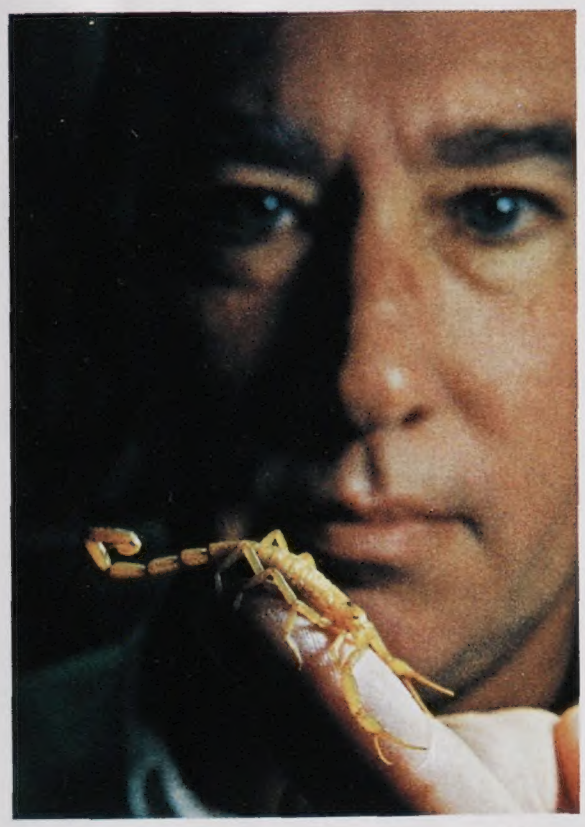

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MUSEUM OF FINE ARTS, BOSTON

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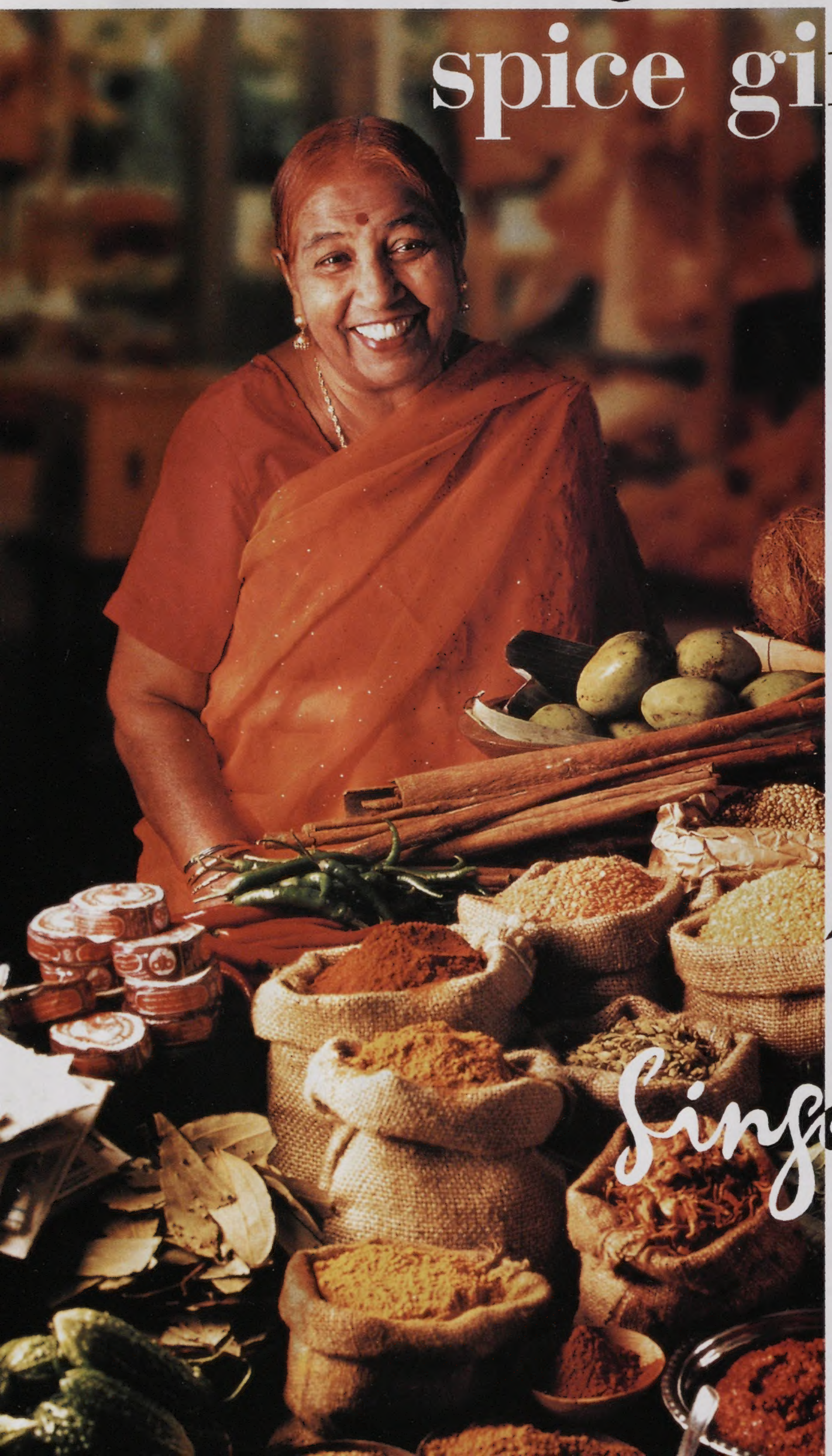

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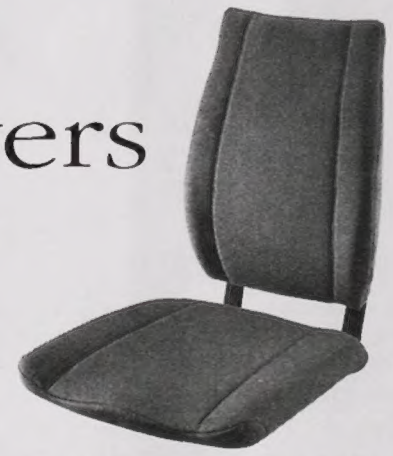

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SMITHSONIAN PERSPECTIVES

Creature Keepers

CONSERVATION AND RESEARCH REMAIN KEY ELEMENTS IN THE NATIONAL ZOO'S EVER-EXPANDING PROGRAMS

WHEN I FIRST BECAME SECRETARY OF THE SMITHSONIAN Institution, I was somewhat puzzled at the presence of the National Zoological Park in our family of museums, galleries and research centers. The Zoo, in fact, dates back more than 100 years. A major impetus for its creation came from William Temple Hornaday, a taxidermist at the National Museum, as the Institution's gallery and collections were then known. He wanted to display natural-looking specimens of American animals and thought that this could best be achieved by first studying living animals. He persuaded Secretary Samuel P. Langley to allow him to "go West," collect live bison, and bring them and other animals back to Washington. His experience on the prairies convinced him that there were American species in danger of disappearing forever. Hornaday housed bison behind the Smithsonian Castle, and they became a popular attraction. Partly as a result of this attention to living animals, he was able to advocate the establishment of a zoological park as part of the Smithsonian. (He left before it opened, and later became the director of the New York Zoological Park.)

The Zoo's mission as stated in the 1889 legislation establishing it was "the advancement of science and the instruction and recreation of the people." On April 30, 1891, two elephants, donated by a circus, and a crowd of schoolchildren paraded from downtown Washington to the new park for the official opening.

From the start, the Zoo's funding was somewhat anomalous, with half provided by the District of Columbia and half by the federal government. In 1966, the entire operating budget was turned over to the Smithsonian. Another measure that greatly assisted the development of the Zoo was the establishment in 1958 of the Friends of the National Zoo (FONZ), a group of concerned citizens devoted to expanding the Zoo's programs and facilities.

In 1972 world attention focused on the Zoo when China donated a pair of giant pandas to the people of the United States. These animals became the subject of national and international interest and stimulated Zoo research in the field of panda biology. The female, Ling-Ling, died of a heart attack in 1992. The 29-year-old male, Hsing-Hsing, is still alive though ailing. Plans are under way to obtain a pair of young pandas to continue the Zoo's efforts to further research, emphasize conservation and delight the public.

Today, when more species are at risk worldwide than ever before in the history of humankind, the National Zoo is justly proud of its emphasis on conservation that continues in the tradition of Hornaday. It is also proud of its extensive research programs conducted in the field and laboratory. The Zoo's core programs were enhanced in 1975 by the creation of the 3,000-acre Conservation and Research Center at Front Royal, Virginia, which is a world-class facility for research, animal breeding and conservation training.

In recent years the Zoo has placed increased emphasis on becoming a "biopark," a facility that accentuates the interrelationships among all forms of life. New or reconstructed exhibits remind visitors of this interconnectedness of nature. Amazonia, a re-creation of a rain forest, includes an interactive area where visitors can learn about the biology of Amazonian animals and plants. The Think Tank, which explores the complex behavior of orangutans—how they think, use tools and acquire language—is a major visitor attraction. The upgraded Reptile House now features interactive displays about the creatures' habits.

The Zoo plans a number of new additions for the coming years. These include an exhibition on water, emphasizing its crucial role in all biological systems and current conservation problems. Projects to remodel the Elephant House and Beaver Valley are also in the works, and the Zoo expects to build a new education and conference center in cooperation with FONZ.

A major fundraising initiative by FONZ and the Zoo will seek to raise $2.5 million to support research into the biology and conservation of giant pandas, here and in China, and upwards of $10 million for the construction of the education center and the upgrading of exhibits. The Zoo has come full circle, reemphasizing its early messages of conservation and bioliteracy at a crucial time in the history of life on earth.

I. MICHAEL HEYMAN, SECRETARY

PIRANHAS

DANG! IT WASN'T ALL THAT LONG ago we learned that the fearsome killer whale was, in reality, quite inoffensive to man. Now Richard Conniff tells us, in the July 1999 issue, that the savagery of piranhas is more myth than fact, that they are often timid and prefer nipping the tails and scales off other small fish to devouring our human flesh.

Tails and scales, indeed. Next you'll be telling us that Flipper the dolphin is a cold-blooded killer.

Edward G. Koran
Phoenix, Arizona

IF ANYONE HAD TRIED TO TELL ME that someone could write about piranhas with a sense of humor, I would not have believed it. Richard Conniff's "Relax, It's Only a Piranha" was engrossing, enlightening and entertaining, which is no small feat considering the detestable subject.

Erin Nathe
Los Angeles, California

DANCING ROCKS

AFTER READING YOUR ARTICLE BY Robert Evans on the puzzle of the dancing rocks of Death Valley, I believe a more plausible explanation for their movement than the wind and ice theories is seismic activity. The debate may never be settled, but if it is, the answer could be earthshaking.

Joseph Smooke
Fairborn, Ohio

I WOULDN'T PRETEND TO KNOW THE answer to the dancing rocks of Racetrack Playa, but the speculations of scientists leave me and my eighth-grade education a little confused. A wind which is strong enough to skid huge rocks for long distances over the ground but is not strong enough to blow out the skid marks is hard for me to imagine. In Montana we have some pretty windy days, and some people say that we have some pretty windy people, too, but we're not in this league.

Bill Craig
Helena, Montana

HAS ANYONE TESTED THE MAGNETIC content of the rocks? Perhaps something in the heavens above, or below the earth's crust, is causing the rocks to move.

Sue Westlake
Clinton Township, Michigan

I HOPE THAT NO ONE EVER FINDS out what makes the rocks move. Knowing how would destroy the magic. Perhaps Isaac Newton was wrong about this gravity thing. Since these rocks seem to twist instead of roll, does this mean that they can gather moss if they so choose? Ah, so many questions, so few answers.

Jim Christensen
Grayslake, Illinois

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AS A REGISTERED PROFESSIONAL FORester, I read with considerable interest your article "A Town Buries the Axe" by Edwin Kiester, Jr. As the former head of timber management planning for the national forests in California, I am probably the chief instigator of the U.S. Forest Service's clear-cut harvest program of the 1980s.

The primary objective of the clear-cut program was to restore the partially harvested areas of the previous harvest cycle to productivity. Previous harvest activities ranging from selective high-risk tree removal to releasing the understory were obvious failures, with the harvested areas being converted into brush fields in stages. Successful regeneration of pine requires an initial bare ground condition and plenty of light. It was my hope that if we could concentrate the timber harvest to those areas already partly cut over and in need of repair, we could leave the rest of the forest relatively undisturbed for other, non-commodity uses.

Historical photographs that I have seen of the area around Quincy 100 years ago show the mountains to have been virtually denuded. The pines in most of the pictures accompanying your story had their start about a century ago. The country around Quincy and other gold-mining areas had populations several times their current numbers, and those people used a lot of wood. Also, the Western Pacific Railroad, which connected San Francisco to Chicago through Plumas County, hauled wood products to both destinations and points in between.

There is no question that the current fuel accumulation is a severe hazard and needs to be reduced. If the intent is to burn the forest to open it up and reduce the fire hazard, then harvesting some timber first to control the amount of fuel and pay for the subsequent burning would be reasonable. The idea that someone might make a profit or draw wages from forestry-related activities troubles a very vocal group of people. That the Quincy Library Group produced a plan that would allow such activity is a significant achievement.

Jack Levitan
Piedmont, California

YOU REPORTED THAT THE QUINCY plan will pursue group-selection logging rather than clear-cutting. Group selection, however, is a type of clear-cutting that calls for a larger number of smaller clear-cut areas, sometimes requiring more logging roads. It's a nice new name but with the same, if not a worse, result. Isn't it about time

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we all recognize that our forests provide a lot more jobs than stumps do?

Rachel M. Fazio
Livermore, California

U.S. HIGHWAY 89 DOES NOT RUN near Quincy or through California, but California State Highway 89 does.

Alfred Perry
Clovis, New Mexico

PHENOMENA, COMMENT & NOTES

JOHN P. WILEY, JR.'S COLUMN "HELP Is on the Way" will certainly help me. For years my family and friends have snickered and joked when I spoke of my pet chickens and their companionship being similar to that of dogs and cats. I felt vindicated by

Blues singer Anna Griffin croons to her two cockatiels at St. Louis' NHC HealthCare.

Karen Kasmauski's photograph of Crisco the chicken, the popular pet at a St. Louis-area health-care center.

After a usual day of chaos teaching middle-school mathematics, nothing soothes me like an hour or so with my birds. They are endlessly entertaining, curious and affectionate, and will happily sit in my lap for petting, just as Crisco does. My 7-year-old rooster Tuffy is the benevolent boss of the dogs, cats and 42 other birds with whom we live.

Every person who has ever made "Colonel Sanders" jokes about me will see your wonderful story.

Diane M. Young
Spicewood, Texas

MANY LONG-TERM CARE FACILITIES IN the United States have adopted the Eden Alternative theory of Dr. William Thomas and have remade their homes into human habitats for the living rather than institutions for the elderly, frail and forgotten. The approach is to stop relying on organized activities and prescription drugs to keep residents busy and manageable. "Edenized" nursing homes toss out boring artificial plants and bring in live ones, and some patients cultivate outdoor gardens in fields or planters. Birds, fish, cats and dogs don't just visit for pet therapy, they reside at the facilities. The human residents care for the plants and animals with assistance from staff and volunteers. The admirable aim is to eliminate what Dr. Thomas calls the three plagues of long-term care institutions: loneliness, helplessness and boredom.

Geneva Spriggs
Washington, D.C.

YOUR COLUMN TALKS ABOUT THE healing and soothing effects that animals can have, especially on the infirm and elderly. Unfortunately, all too many condominiums and rental properties have strict "no pets" rules. We are denied the pleasure of knowing the love of a pet and having the motivation for getting up each day to take care of an animal friend.

I am a widow and miss the companionship that a small animal could give me. My friends and I can fill our days with volunteer work but oh, those empty nights.

Harriette F. Shulman
Lauderhill, Florida

WHILE LIVING IN TULSA, OKLAHOMA, I had a friend who was active in the local Society for the Prevention of Cruelty to Animals and their Pets Are Love (PAL) program. On Saturdays, PAL volunteers take dogs and cats that have been screened for temperament and socialization to local retirement and nursing homes for pet therapy. It seemed like a cool idea, so I went along one weekend and was put in charge of an aged, permanent shelter pet, a Pomeranian named Tiffany, who mostly sat on laps and stuck out her tongue.

The dozen or so dogs and cats, the other volunteers, Tiffany and I were greeted by about 40 ambulatory gray-haired "youngsters" who had eagerly awaited the animals' arrival. As the residents petted, stroked, kissed and cooed over the dogs and cats, they spoke animatedly about all the pets they had loved during their lives. Our one-and-a-half-hour visit turned into three, and I became a regular weekend volunteer. I never had so much fun in my life.

Laura Remington
Grand Prairie, Texas

BRITAIN'S MONASTIC RUINS

THANK YOU NOT ONLY FOR THE EXquisite night photographs taken by Berthold Steinhilber of England's bare, ruined choirs but also for the agonizingly honest text by Suzanne Crawford that accompanied them. King Henry VIII's willful destruction of still-active, and largely faithful, monasteries stands as one of England's most shameful moments. The landed gentry, now to the manor born, owed their wealth and their great country homes not to a flourish of creativity but to a brutal, vicious act. Rarely has the world seen such "religious cleansing" as that wrought by the king of six wives.

The Rev. Larry Bailey
New York, New York

I HAVE NEVER SEEN ANYTHING SO hauntingly beautiful as the photographs by Berthold Steinhilber.

Roy Fougere
Pittsboro, North Carolina

KAREN KASMAUSKI

DON'T MISTAKE

A Street Address

For Where You Actually

LIVE.

THE LAST PAGE

LIKE KEN BUDD, WHO WROTE YOUR *Last Page* column "Being Superstitious Can Drive You Crazy," I am not superstitious. I have noticed as a fact, however, that when the Phillies are behind, they are much more likely to rally and win if I switch the TV off and tune in on the radio.

James M. Marsh
Rosemont, Pennsylvania

I WAS SURPRISED THAT YOUR COLumn didn't include my husband, John. You must know him. It was his pair of lucky socks that got the Atlanta Falcons to the Super Bowl.

Mr. Budd also didn't mention our guilt when we think we have failed as fans. When NASCAR driver Jeff Gordon hit the wall in Texas and was wincing in pain, I had a sinking feeling. I was wearing a Jeff Gordon T-shirt but not the lucky one. Then I realized that what I have on is totally irrelevant to the race. I do still wear my lucky shirt. It can't hurt.

Beatrice Engelmann
Roswell, Georgia

THE OBJECT AT HAND

YOUR ARTICLE ABOUT THE RUSSIAN chess pieces was fascinating; however, you confused the knights with the bishops. The white knights might have attitude, but the white bishops are the men who would have "effete" attitude since bishops are known, in chess, as the effete pieces.

Beverly Fix
Spring Lake Park, Minnesota

MODEL PLANES

THE THOROUGH ARTICLE "PILOTING Pint-Size Planes" was beautifully written by Richard Wolkomir and photographed by Robert Burke. I, too, have the "disease," and living in California, I'm fortunate to enjoy year-round flying weather.

Learning to fly doesn't have to be a crash-prone and frustrating experience. Not much is learned when 30-second periods of panic in the air are punctuated by weeklong repair sessions. The computer-based flight simulators that Mr. Wolkomir mentioned can help students "get their thumbs." New pilots develop the reflexes required to return an out-of-control aircraft to a stable attitude. The advantage is that new pilots can return to the "air" immediately following a crash, allowing them to try the same maneuver again and learn from what they had previously done wrong.

Additionally, most clubs are now equipped with a "buddy box." Both the instructor and the student hold

transmitter controls that are linked by a cable. If the student gets into trouble, the instructor can easily regain control with the press of a button, giving the student a little time for the adrenaline to subside.

Greg Heumann
San Mateo, California

FOR SEVERAL YEARS, I HAVE FLOWN radio-controlled planes. My first flight was very shaky, but I am glad that I took that first step.

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David Garrett
Greensboro, North Carolina

IN MY EXPERIENCE, MOST ARTICLES speak patronizingly about the people who play with toys, but yours did not. The pint-size-plane hobby is almost as old as the century, and radio control is fairly new.

The "real" hobbyists build and fly airplanes without controls. Whether or not they fly well depends on the adjustment skills of the builder/flier. "Free flight" is a sport played regularly by competitive, international teams. Competition includes extremely light and delicate "indoor" models, fast-climbing "power" models, graceful sailplanes, and even small hand-launched gliders.

Avid L. Hicks
Washingtonville, New York

MAXFIELD PARRISH

THANK YOU FOR BRUCE WATSON'S thoughtful article "Beyond the Blue: The Art of Maxfield Parrish." The American Federation of Arts co-organized the "Maxfield Parrish: 1870-1966" exhibition with the Pennsylvania Academy of Fine Arts.

Lisbeth Mark
American Federation of Arts
New York, New York

WRITE TO SMITHSONIAN

Letters for consideration in this column must include your full name, address and daytime telephone number. Transmit mail to LettersEd@simag.si.edu or send it to Smithsonian Letters Editor, P. O. Box 44400, Washington, D.C. 20026-4400. Letters may be edited for clarity and length. Send all other queries and comments to Smithsonian, 900 Jefferson Drive, Washington, D.C. 20560-0406.

Businessman's volunteer spirit
Community activist Anthony Sampson urges young people to visualize success.
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PHENOMENA

COMMENT & NOTES

A Census of the Wild

A GOVERNMENT REPORT TAKES A LOOK AT WHAT WE HAVE LEFT AND WHERE WE ARE HEADING

BY JOHN P. WILEY, JR.

THE FIRST THING A BIOLOGIST WANTS TO KNOW about a piece of land or water is what lives there. Gather as many specialists as you can—a moth woman, a worm man—and take a census. It's the logical first step when a university acquires a new field station or the Nature Conservancy a new preserve. The urge to know what's there runs much deeper and wider, however. In the United States, for example, both the government and field biologists have long wanted to know everything that lives here in the whole country. People have tried to do that in Costa Rica, a very small country. We've tried, too.

A century ago the U.S. Biological Survey, a new division of the Department of Agriculture, set out to discover what we have in the way of living natural resources. It was no small effort. In Texas, for example, a dozen scientists and field agents worked from 1889 to 1906 at 178 different sites in all ten ecological regions of the state. As the years went by, however, the emphasis changed, and the division, by now a bureau, became part of today's U.S. Fish and Wildlife Service at the Department of the Interior.

In this decade the government made a new start on the original goal, with the formation of the National Biological Service within the Department of the Interior. In 1995 it produced *Our Living Resources,* a compilation of reports from scientists on what they were monitoring—and what they were finding. In 1996 the service was folded into the U.S. Geological Survey as a fourth major branch, the Biological Resources Division. And now this incarnation has produced the first comprehensive report, *Status and Trends of the Nation's Biological Resources.* By no means a complete census, it is more a synthesis of what we do know so far and a look at where we're going.

Now a 964-page government report, in two volumes no less, is not the first thing most of us would turn to for fun and relaxation. This one, however, may belong to a previously unknown phylum. The language is what computer people call "user friendly." It's loaded with color pictures, sidebars, tables, drawings and graphs. The big news, though, is the effect it has on the reader. In the process of detailing the sorts of problems our remaining wild things face, and going through region by region overviews, *Status and Trends* is a reminder of how much is still left, how many creatures and ecosystems the reader may have never seen. The logical response to Stock #024-001-00717-6 at the U.S. Government Printing Office would be to rush out to the airport, run up to any counter, and say: "Quick! Give me a ticket to anywhere," or simply drop to the ground (not on the sidewalk) with a magnifying glass.

The first part of the book is a minicourse in ecology, a discussion of forces that have an impact on our natural resources. Some forces are natural—hurricanes and volcanic eruptions. Some may or may not be natural, such as climate change. Some are our own handiwork: land use, water use, nonindigenous species, pollution and "harvest," meaning the mammals, birds, fish, shellfish, mushrooms, orchids and medicinal plants we remove. Those of us who

Even as they are reintroduced into Yellowstone National Park, gray wolves are returning of their own accord to Minnesota, Wisconsin and Michigan.

LYNN AND DONNA ROGERS

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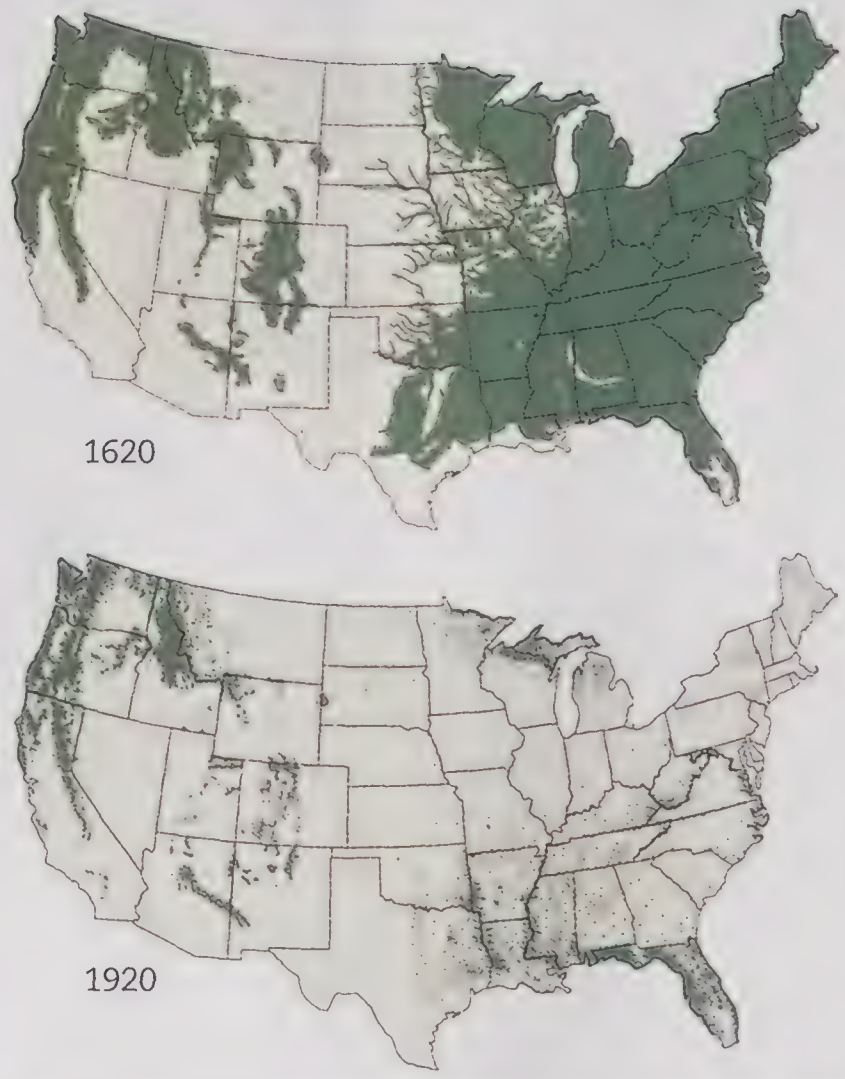
live east of the Mississippi would do well to contemplate the maps showing the history of virgin old-growth forest in these United States. Most of ours is long gone. So we are hardly in a position to complain about what's going on today in the Pacific Northwest—or in Latin America, for that matter.

Climate change can give you a chill when you learn what it is that limits birds from extending their range northward. It has to do with how much fat a bird has left at dawn, when it can renew the search for food. (That's not a rule that can be extrapolated to humans. If it were, I could live comfortably at the North Pole.) Another way to say the same thing is that if a bird has to run its metabolism at more than 2.5 times the basal rate on a winter night, it won't make it.



Maps of virgin old-growth forest show that the eastern half of the country once had the most but has lost nearly all of it.

Alien invaders are doing much better than I ever dreamed: New York may have lost the human population crown to California decades ago, but it maintains a lead in nonindigenous plant species, 1,122 to 1,113.

The second part of the book is the one that could send you to the airport. It describes trends in the biological resources of 14 regions of the country, with an additional chapter on our marine ecosystems. Each section provides a physical description of the region and outlines historical and current land use. It then describes the principle ecosystems to be found, giving their status and trends. Next it does the same for fishes, reptiles and amphibians, birds, mammals and, sometimes, invertebrates. Plants tend to be discussed in the ecosystem write-ups.

In the section on the Southeast, there is a sidebar on the southern tip of Texas, where the Rio Grande meets the Gulf of Mexico. (Texas west of the Pecos River appears in the Southwest section.) A habitat I'd never heard of, Tamaulipan brushland, hangs on by a thread there.

It comes in several varieties, but all consist of dense, woody and usually thorny vegetation, often interlaced with streams. Not very interesting or inviting, until you read that more than 600 vertebrate and 1,100 plant species are found there. The vertebrates include two rare cats, the jaguarundi and the ocelot. Chances of seeing either are vanishingly low, but it's nice to know they're still there.

Most of the trends reported in these volumes are, unsurprisingly, negative: declines in the numbers of individual species, declines in habitats such as wetlands. But there are surprises. In the section on grasslands, running up the center of the country from Texas to Canada, there are maps of the ranges of endemic bird species. The maps are color-coded, with shades of purple indicating declines and shades of green for increases.

On the maps, most of the birds appear to be holding their own, and some, photogenic ones like the ferruginous hawk and the Mississippi kite, are increasing across parts of their range. Some of it has to do only with shifts in where they breed, but it's nice to look at the maps and see more green than purple.

Nature isn't all handsome birds of prey. In the section on the Southwest, I came across cryptobiotic crusts found in arid lands: living layers on top of what would otherwise be bare soil. It never would have occurred to me that this crunchy stuff was alive, but apparently it is a community of blue-green algae (now also known as cyanobacteria), lichens, mosses, microfungi and bacteria. The "crust" is created whenever there's enough moisture for the algal filaments to move through the soil, leaving behind a mucilaginous substance that binds loose dirt particles. The crusts reduce wind erosion, store water when it rains, and add nitrogen and organic matter—both always in short supply in desert soils—to the ecosystem.

Pleasant little surprises pop up here and there. In the references for the section on Puerto Rico and the Virgin Islands, the name T. A. Wiewandt appears. This is Tom Wiewandt, a first-rate photographer whose work has appeared in this magazine. The reference is to his 1977 doctoral dissertation, "Ecology, behavior, and management of the Mona Island ground iguana, *Cyclura stejnegeri*." (Mona Island is a 13,633-acre wildlife refuge off the west coast of Puerto Rico.)

For the people who manage our natural resources, *Status and Trends* is an important beginning. For amateur naturalists, it is somewhere between a reference book and a travel guide. It is something I never thought I'd say of a government report: hard to put down.

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Outsmarting Napoleon

WAR GAMES ENTHUSIASTS USE MINIATURE SOLDIERS AND MULTIPLE-TERRAIN BOARDS TO SIMULATE REAL BATTLES

BY MICHAEL KERNAN

SOMETIMES IT STARTS WITH chess, a most abstract form of warfare, with rigid rules and little identical armies. Sometimes a young player wants more "reality," more of a sense that this is indeed a battle, and discovers commercial board games simulating war. And then he wants his own army.

For Douglas Mudd, it was a miniature battlefield that he saw one day—Hannibal versus the Romans, on an 8-by-4-foot table fixed up with grass, trees and a gently hilly terrain. There were the Romans in their phalanxes, each tiny shield hand-painted, and there were Hannibal's famous elephants, the spearmen, the bowmen.

Mudd, who manages the National Numismatics Collection at the National Museum of American History, started buying unpainted miniature soldiers and soon was deep into military history, researching not only the battles themselves but the uniforms worn at the time. Military medals struck to commemorate famous battles, plus ancient coins showing soldiers with decorated shields, provided a great source of information about the look of things.

From painting miniature soldiers to fighting their battles was just a step. Soon Mudd was competing in war games based on historical battles. Game participants deploy miniature troops on a board that looks like a three-dimensional representation of the terrain covered in the actual battle. "I love the strategical challenges of putting myself in the shoes of a known general to see if I could do better than he did," says Mudd.

Douglas Mudd, manager of the Smithsonian's numismatics collection, and war games hobbyist, displays unpainted figures wearing Renaissance uniforms.

"War-gaming began in the 1840s," he tells me. "The Prussians wanted to analyze what happened with Napoleon, how he could beat them even though they had a large, well-trained military. How could they anticipate what a genius could do? So they created the general staff, a pool of officers trained in all aspects of war, logistics, battle tactics. They tried to see if this group of officers could simulate what would happen if you had a genius like Napoleon against you."

They set up teams of officers in separate rooms, with maps, a chain of command, rules and referees. By the 1860s *Kriegspiel* was being used by major European countries for military training. Civilian war-gaming spread with the aid of *Little Wars*, a 1913 war-gaming book by H. G. Wells. But these civilian simulations were relatively crude compared with the sophisticated war games that devel-

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oped later, in the wake of World War II and the Korean War.

Today, model soldiers appear in many sizes, from 2 to 25 millimeters. The 15-mm figure, a bit over half an inch high, is the most common and is relatively cheap.

"Most of my troops are that scale," says Mudd, "although I now prefer 25 mm: I can afford them now and they're a little more detailed. The problem is, if you re-create any large-scale battle, you need a big table—minimum size, 5 by 8 feet."

The rules are the heart of it all, and the rules are incredibly complex. I still wonder how any set of fixed regulations could come anywhere near simulating the madness of a real battle.

Look at what happened on October 25, 1854, at the Battle of Balaklava during the Crimean War. A huge body of Russian cavalry, 3,000 to 4,000 strong, threatened to overrun the base camp of the Allied army, consisting of British, French and Turks. Routing the Turk defenders, the Russians forged ahead.

All that stood between the Russians and the base was Sir Colin Campbell, 550 of his 93rd Highlanders and 100 invalids. Campbell had his men lie facedown in their red coats, in a threadbare line just two men deep, along a hillock. "Men, remember there is no retreat from here," Campbell famously told them. "You must die where you stand." Four cavalry squadrons bore down on them. Suddenly they leaped to their feet.

They fired a volley from their muskets, every bullet aimed. The Russians wavered, came on again. A second volley, another hesitation. Some Highlanders pushed forward for a hand-to-hand fight. "Ninety-third!" shouted Campbell sternly. "Damn all that eagerness!" A third volley, and the Russians wheeled about and withdrew toward the main body of the cavalry. Impossible, but it happened. That brilliant stand was immortalized as "the thin red line."

Fierce 16th-century German pike units—known as *Landsknechten*—used tight formations to thwart their enemies.

How do you write rules that cover such stranger-than-fiction scenarios—the infamous fog of war?

"Well, there's hundreds of sets of rules," says Mudd. "They're divided up into periods: the ancient period goes up to the edge of gunpowder warfare, about 1450, covering 3,000 years of history: swords, pikes, armor, spears, shields, et cetera. Then there's the pike and shot period, to 1600, and the horse and musket period, from 1600 to 1785. And so on."

There are rules for large-scale battles, rules that balance different types of troops, so that if one player has, say, soldiers of the Trojan War totaling 300 points and another has 300 points' worth of soldiers from the Persian Wars, much later, it will be an even matchup.

"There are a dozen very focused rules for the Frederick the Great era, accounting for the special characteristics of each army." For instance, Napoleonic armies had light infantry or skirmishers, who move at a certain pace, and more heavily armed grenadiers, who move slower and act differently in a given situation. "Infantry might move six inches per turn on open terrain, but only three inches if crossing a river or going through woods."

Other factors cover fighting ability—the difference between feared Guards troops and militia—or the impact of morale. And dice are used to add that element of luck that can thwart even the best general.

The rules for a game in which you are following historical fact would be different from those for a battle you are making up. Sometimes you can move troops and have them fire in the same turn; the dice decide how many you kill. Sometimes the rule proclaims that communications failed, so your men move but are too confused to fire.

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Try imagining a chess game in which one of your knights goes lame. Or a pawn refuses to advance.

"I do have some World War II troops," Mudd informs me, "but basically I stick to pre-19th century. I don't do Napoleonic wars anymore. I just don't have the time to paint those large armies. You need 120 to 150 figures for a battle [the usual scale is one figure for 60 men], but if you want a large army you need some 300 figures."

Mudd's speciality is the wars of Frederick the Great, from about 1760 to 1780, "although recently I have been involved in the Italian wars, so I have an army of Charles V of Hapsburg, and I've also got Spanish, German and Italian troops of the 1550s."

Mudd has built a considerable collection of books on battles and uniforms. It's amazing, he says, how a skilled painter can give character and identity to even a flea-size soldier two millimeters high.

Uniforms greatly aided morale. The tremendous shakos and busbies worn by grenadiers made them look ten feet tall, and with their trademark piratical mustaches they looked as fierce as Gauls.

In the age of gunpowder, uniforms were a vital means of keeping a unit together, for as soon as the first volley was fired at a range of 50 yards the entire field would be obscured in dense smoke "and you couldn't see men five yards down the row," explains Mudd. Thus, each company often had two flags, six feet square, designed to be seen.

Mudd, a Washington native who is only distantly related to Dr. Samuel Mudd of Civil War fame, has about a thousand 15-mm figures and 500 of the 25-mm soldiers, plus many still unpainted. He says a fan gets excited about a period or battle, collects the soldiers for it, then moves on to another one.

A half-dozen major firms handle war games, some specializing in figures, some in rules, some in paints, a few in a variety of items. Some also produce fantasy-gaming products, though most historical games manufacturers are purists who prefer not to be identified with the fantasy field (big with younger crowds brought up on games like Dungeons and Dragons).

War-gaming cannot be blamed for the shootings in Littleton, Colorado, and similar tragedies, I think. For one thing, the average age of the players is around 35. And even though some youngsters do tend to start with fantasy gaming, "it's like the whole TV issue: most people know it's not real life," says Mudd. Moreover, many young players get into historical gaming from the start.

I ask about the role of electronics, which seems to play a large part in fantasy gaming. "The computer is perfect for certain random events," he replies, "and it can keep track of a complex situation, but it's not easy to combine with gaming. It's certainly better than rolling the dice forever, but it's most commonly used in sea battles, which are very technical. If you fire a 16-inch shell, you know how much damage it will do, so you don't need charts—the computer figures it instantly."

An inch-high representation of Trojan hero Sarpedon, holding spear and shield, rides inside a Bronze Age chariot.

But it's the hands-on aspect that fascinates Mudd and many others. He will spend hours painting a single tin-and-bismuth figure (lead soldiers being medically incorrect) in acrylics, sometimes two hours just on one flag. His coin research shows him the designs that might appear on, say, a Theban soldier's shield. His soldiers have won first place in the Masters Category at the Historicom Convention, put on in Lancaster, Pennsylvania, by the Historical Miniature Gaming Society. And he has won quite a few tournaments in a fairly abstract game involving 12 pieces on a side. "It can be played in under an hour, it's fun and very simple, and it's a decent simulation, 60 percent skill, 40 percent luck," Mudd says. "On the other hand, I haven't done very well with my Charles V army. I spend a lot more time painting and researching those figures than fighting with them."

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THE OBJECT

AT HAND

The Man Who Invented Elsie, the Borden Cow

BY CAROLYN HUGHES CROWLEY

IT IS AN ODDLY SHAPED COPPER KETTLE OFFICIALLY designated as a "vacuum pan." It sits in a corner of the Agricultural Hall at the Smithsonian's National Museum of American History, a relic of the one great invention by an inveterate tinkerer, almost all of whose other inventions failed.

The man was Gail Borden. The memorable invention was condensed milk, though most of us are more likely to think of its symbol, Elsie, the Borden Cow. Before Borden, milk was a child's food, difficult to keep fresh, likely to carry germs—as Louis Pasteur would prove—impossible to preserve safely for more than a day or two. After Borden received a patent in 1856 for "producing concentrated milk in vacuo," condensed milk became an important part of the dairy industry. For the first time milk could be kept pure and storable without benefit of refrigeration. For the first time, too, it could be distributed over great distances.

Gail Borden used this copper vacuum condenser for his first successful milk experiment.

Borden was 54 years old that year. He had had little more than a year of formal schooling and possessed no scientific training whatever. But all his life he was consumed with a passion for research, and a desire to improve daily life. Years before Pasteur's experiments, he sensed that a relationship existed between dirt, freshness and the quality of milk. "Milk is a living fluid," Borden would write in 1856, which "as soon as drawn from the cow begins to die, change, and decompose."

The perception sharpened in 1851 when, returning from a trip to England, he was devastated at seeing children die aboard his steamer apparently as a result of scanty milk from shipboard cows. He went back to a notion that he had long held that all sorts of foods could be condensed and preserved, which would make them safer.

Borden was not the only one who tried to keep milk from spoiling, but the others generally cooked it in the open air over a hot fire, and it always burned, became discolored or turned sour. Borden's better idea used a vacuum pan similar to the ones he had seen the Shakers of New Lebanon, New York, using as they condensed fruit juice. Inside his vacuum pan a heating coil warmed the milk slowly and evenly, allowing gradual evaporation without excessive heat and scalding. Milk is three-quarters water; after the water had vaporized, what was left was condensed milk.

"Milk will be as common as sugar" on shipboard, he wrote in 1855. After two false starts, he opened a milk condensing factory in Wassaic, New York, and soon was peddling condensed milk door-to-door. He pioneered in its sanitary handling by enforcing strict health guidelines on farmers. If they wanted to sell him milk, he insisted they wash udders thoroughly before milking, sweep barns clean, spread manure away from milking stalls, and scald and dry their wire-cloth strainers morning and night. The milk business boomed. In 1858, the Committee of the Academy of Medicine was quoted as declaring that Borden's milk was "unequaled" in purity, durability and economy.

When the Civil War came, the federal government ordered condensed milk as a field ration; soldiers home on leave told their families about milk that stayed fresh indefinitely. Borden's production of it for the Army never caught up with demand.

By the late 1860s condensed milk had changed the dairy business from a haphazard farmer-to-consumer operation into a major industry. Condensed milk made Borden rich, respected and famous. But that success came only after a series of often ludicrous failures.

Martin Ford, Cardmember since 1997

On a recent trip abroad, I met up with some joker on St. Albert Street. After asking me for a light, he clocked me. My wallet? Gone. My face? Still there. Broke and unable to speak the language, I called American Express. They got me a translator, settled my hotel bill, and sent me a new Card the next day. Thanks. It only hurts when I laugh.

do more.

One of the first involved his attempt to wipe out yellow fever in Galveston, Texas, where he lived in 1844. That year, his wife, age 32, and 4-year-old son contracted the disease, swiftly sickened and died.

Shocked and grieving, Borden thought hard about yellow fever. It mostly struck in summer, abating after the first frost, and some 60 years before Walter Reed discovered that mosquitoes carried the fever, Borden decided he would simply chill the dread disease out of existence with a giant refrigerator. He planned to use ether as a cooling agent to help cool his fellow citizens back to health. "I mean to keep you for a week as if under a white frost," he wrote. "If we had the refrigerators ready I could lock up every soul in a temporary winter." Fortunately nobody volunteered.

He also launched his "terraqueous machine," a combination wagon and sailboat supposed to run equally well on land or sea. One night he invited guests for a midnight dinner concocted, he explained, out of material "from which, if you knew what they were . . . you would turn with loathing and horror. I have transmuted even the dirt itself into delicacies." After dinner, Borden led his guests to the machine, a horse and wagon with a mast and a square sail in front rigged with pulleys and a device to make the wheels serve as makeshift paddle wheels. Screaming passengers made him stop at water's edge. On another outing, he rolled the ponderous contraption down into the water, where it instantly capsized, dumping everybody into the Gulf of Mexico.

"Where's Borden?" someone yelled.

"Drowned, I do most sincerely hope. He richly deserves it," a soaking guest responded.

Borden's next try, not an entire disaster, was meat biscuits. In the 1840s he boiled 120 pounds of beef down to 10 pounds, dehydrating it, mixed flour with the residue, kneaded the substance into biscuits and baked them. A navy doctor complained that many people found them "absolutely disgusting," something like melted glue and molasses. Still, during the gold rush, a party of forty-niners carried Borden's biscuits to California, and people ate them on an Arctic expedition. The *Scientific American* described the biscuit as "one of the most valuable inventions that has ever been brought forward." But the Army, which might have made the biscuit a financial success, decided it was "not only unpalatable, but failed to appease the craving of hunger—producing head ache, nausea, and great muscular depression." The biscuit business failed, driving Borden to bankruptcy in 1852.

An 1886 poster suggested healthier babies would result if mothers used Borden's condensed milk.

"I am entirely out of money," he wrote a friend. "I have had to parcel out my family among my friends and relatives. My wife [his second] is in one place, my daughters in another and every piece of property I have is mortgaged. I labor 15 hours a day."

Such failures did not dampen Borden's faith in his inventions. "There is no use in looking back," he told a friend. "If I did, I should soon be dead or in a mad house."

Harking back to his earlier thoughts on condensing and preserving perishables, he began trying to condense everything. "I mean to put a potato into a pillbox, a pumpkin into a tablespoon, the biggest sort of watermelon into a saucer. . . . The Turks made acres of roses into attar of roses. . . . I intend to make attar of every thing."

Sometimes the problem was purely commercial. He condensed 6.5 gallons of apple cider into one gallon, but had few takers. During the Civil War, he broke one of his most rigid rules—no Sunday work—to produce concentrated blackberry juice. He shipped the entire batch for free to Gen. William T. Sherman, who wrote back to thank Borden for doing more than all the Army surgeons to overcome an epidemic of dysentery.

Borden died at 72, admired and liked by everyone who knew him, those who thought he was a genius and those who thought he had a screw loose. The Borden Family of Companies, named after Gail Borden, does nearly $3 billion of business a year. It sells industrial chemicals, consumer adhesives, housewares and packaged foods—and licenses other companies to sell milk, ice cream and cheese under the Borden name.

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SMITHSONIAN

HIGHLIGHTS

"One head does not constitute a council" is the message this Asante chief conveys through the pattern on his kente cloth robe. Kente, woven since the mid-17th century by the Asante and Ewe peoples of Ghana and Togo in West Africa, is often used in royal regalia or worn at festivals and ceremonies. Each motif has its own name and meaning, usually derived from leaders, events or proverbs. In the United States, kente achieved prominence over the past 40 years as a symbol of African-American cultural heritage and pride. The exhibition "Wrapped in Pride: Ghanaian Kente and African American Identity" will be held at the National Museum of African Art and the Arts and Industries Building, September 12-January 2, 2000. *—Naila-Jean Meyers*

Connecting with Kente

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SMITHSONIAN HIGHLIGHTS

Back to School with Smithsonian Curators

SCHOLARS IN THE SCHOOLS

Invite one of the Smithsonian's researchers to your school and bring the curriculum to life with topics like "Marine Monsters, Real and Unreal" and "A Spacecraft Tour of the Solar System." Invertebrate zoologist David Pawson, from the National Museum of Natural History, and geologist James Zimbelman, from the National Air and Space Museum, are among the many researchers who can travel to your community and share their knowledge and enthusiasm for learning in classrooms, assemblies, in-service teacher workshops and public presentations. Smithsonian Scholars in the Schools is part of the Smithsonian Associates National Outreach Program, which is designed for audiences outside the Washington area. Local cultural, educational, civic and business organizations can sponsor Smithsonian lectures, workshops and seminars. Other National Outreach programs include: Voices of Discovery, the Creativity Institutes and the World Affairs Institutes. To learn how to bring these programs to your community, visit www.si.edu/tsa/national-outreach/ or call (202) 357-4800, ext. 218 or 274.

Sea Post Clerks Onboard the *Titanic*

NATIONAL POSTAL MUSEUM

The valiant attempt to save the mail aboard the *Titanic* is the compelling subject of a new exhibition. Opening September 17, *Posted Aboard R.M.S. Titanic* honors the ship's five sea post clerks, all of whom perished aboard the ill-fated royal mail ship, and features objects retrieved from the bodies of two of the clerks. More than 3,000 sacks of mail were lost, but only after the clerks worked desperately to save them. Their plan was to drag the bags to the upper decks and await their transfer to another ship. The five were last seen by steward Albert Tessinger, who tried to help the men move the mailbags, and later recalled, "I urged them to leave their work. They shook their heads and continued." The water was already waist high in the mail room when the steward pleaded for the men to give up the hopeless task.

Artist Deb Parsons Menke from Missoula, Montana, flushed out a pair of pheasants for her winning entry in the National Postal Museum's fifth annual Graceful Envelope Contest.

Groundbreaking Ceremony

NATIONAL MUSEUM OF THE AMERICAN INDIAN

"We are so proud to be at this final stage," declares museum director W. Richard West. "We are ready to begin building." Join museum officials and Native Americans at the September 28 celebration when the site is blessed and a ceremonial shovel breaks ground. The event begins at 9 A.M. on Independence Avenue and Third Street, S.W., the last vacant site on the National Mall. The new museum, scheduled to open in late 2002, has one of the most comprehensive collections of Indian cultural materials in the world.

For Bookworms Only

SMITHSONIAN INSTITUTION PRESS

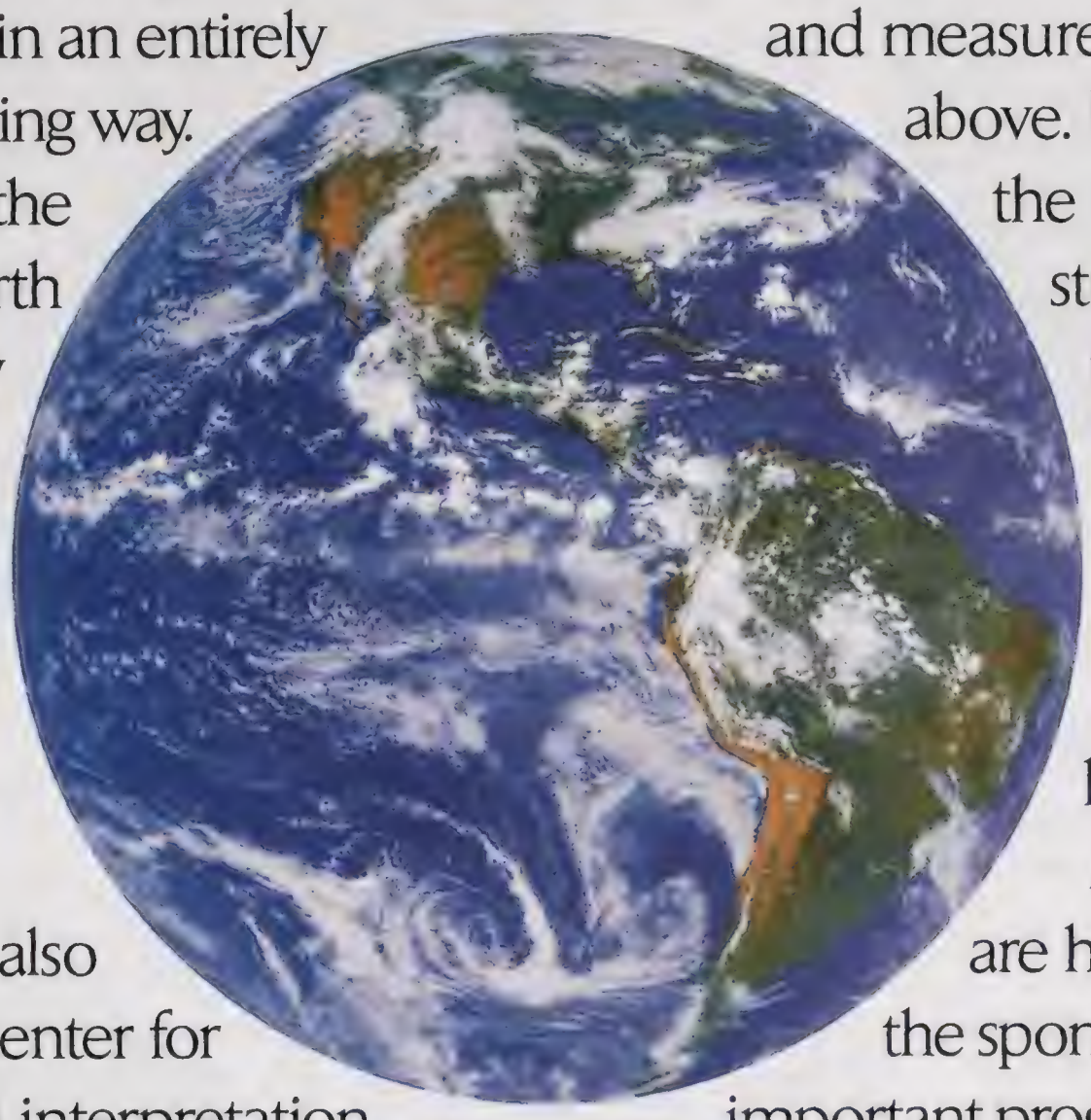
Wings and Warriors: My Life as a Naval Aviator by Donald D. Engen. In his autobiography, the late director of the National Air and Space Museum discusses his remarkable military career and offers a personal glimpse into the development of U.S. naval aviation from the 1940s to the 1970s. Originally published in 1997, it is now available in paperback ($17.95).

Prehistory of Australia by John Mulvaney and Johan Kamminga. Using archaeological evidence and recent discoveries, the authors chronicle 40,000 years of Australian aboriginal cultures, languages and practices ($27.95 paper).

To purchase these and other books published by the Smithsonian Institution Press, call 1-800-782-4612.

"Reflections on Earth"

In Washington, D.C., there's a place where both scientists and students are viewing the earth's environment in an entirely new and exciting way. It's known as the Center for Earth and Planetary Studies, and it's part of the Smithsonian Institution's National Air and Space Museum. It's also the premier center for the study and interpretation of satellite-photograph images.



You see, photos taken from space show incredible patterns of change here on Earth's surface. Rain-forest depletion, soil and sand shifts, natural habitat growth and even crop health can be viewed and measured from high above. Everything the scientists and students learn from these photographs can help us take better care of Earth here below.

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These images, along with resources for teachers and students interested in the earth's environment, are available at www.nasm.edu/ceps/reflect/refl2.html. "Reflections on Earth" is a program of the Smithsonian Institution, National Air and Space Museum. © 1999 American Honda Motor Co., Inc.

Richard Nixon slips past Fred J. Maroon, whose photographs are on view at NMAH.

Smithsonian Website

WWW.SMITHSONIANMAG.SI.EDU

Click on *Highlights Calender* to learn about exhibitions, events, publications and other Smithsonian activities.

Exhibitions and Events

NATIONAL MUSEUM OF AFRICAN ART

Wrapped in Pride: Ghanaian Kente and African American Identity (September 12-January 2, 2000) Cosponsored by the Anacostia Museum and the Center for African American History and Culture, the exhibition examines the history, weaving technology and use of kente. The exhibition continues in the Arts and Industries Building.
Hats Off! A Salute to African Headwear (through December 26) Drawing from its collection, the museum pays tribute to the creative genius of the makers of African headwear and the prestige of the wearers.
Claiming Art/Reclaiming Space: Post-Apartheid Art from South Africa (through September 26) The many forms, ideas and emotions, social and political views, expressed by contemporary South African artists.

ARTS AND INDUSTRIES BUILDING

Wrapped in Pride: Ghanaian Kente and African American Identity (September 12-January 2, 2000) An exploration of the many ways African-Americans incorporate kente cloth in the home, in politics, in religion and in celebration. Cosponsored by the Anacostia Museum, the Center for African American History and Culture, and the National Museum of African Art.
From Bento to Mixed Plate: Americans of Japanese Ancestry in Multicultural Hawaii (through November 30) Personal artifacts, photographs and a small 19th-century locomotive from a Hawaiian sugar plantation.
Revue Noire: Africa by Africans (through January 2, 2000) A celebration of a century of African photography, including studio portraiture, official press photography and works by contemporary artists.

DISCOVERY THEATER

Performances for youngsters. Call 202-357-1500 (voice or TTY) weekdays, 8 A.M.-4 P.M. "Bottom's Dream," premiering September 27-30, is a bilingual adaptation of Shakespeare's *A Midsummer Night's Dream*.

RENWICK GALLERY

Glass! Glorious Glass! (September 24-January 30, 2000) The museum's studio glass collection of 56 works by more than 40 artists reveals every facet of this medium, and includes five works by renowned artist Dale Chihuly.

NATIONAL MUSEUM OF AMERICAN HISTORY

Photographing History: Fred J. Maroon and the Nixon Years, 1970-1974 (through December 5) Many of these intimate and dramatic images by the Washington freelance photographer have never been exhibited before.
Preserving the Star-Spangled Banner: The Flag that Inspired the National Anthem Visitors are invited to observe the conservation process.

NATIONAL MUSEUM OF NATURAL HISTORY

Ainu: Spirit of a Northern People (through January 2, 2000) An unprecedented, in-depth look at the 10,000-year-old culture of the Ainu, the indigenous people of northern Japan.

NATIONAL AIR AND SPACE MUSEUM

Breitling Orbiter 3 The gondola of the first balloon to travel nonstop around the world, in 19 days 21 hours 47 minutes, goes on display September 23.

HIRSHHORN MUSEUM & SCULPTURE GARDEN

Directions—Sam Taylor-Wood (through October 17) A London video artist in her first U.S. museum show.
The Hirshhorn Collection at 25 Two floors of the museum's works, from Thomas Eakins to today's emerging artists, are brought together in celebration of the museum's 25th anniversary.

The locomotive *Olomana* is displayed in *From Bento to Mixed Plate* at A&I.

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The watch of a *Titanic* mail clerk is featured in a show at the National Postal Museum.

NATIONAL POSTAL MUSEUM

The Graceful Envelope (through October 31) On display are the creations of the 75 winners in the annual envelope design competition. This year's theme is the celebration of beauty in nature.
Mayhem By Mail (through April 2000) Explores three categories of crime investigated by U.S. Postal Inspectors.

ARTHUR M. SACKLER GALLERY

Behind the Himalayas: Paintings of Mustang (through September 26) Artist Robert Powell's 19 watercolors depict the sights in the high, treeless, windswept deserts of the Himalayan region known as Mustang.
Yoshida Hiroshi: Japanese Prints of India & Southeast Asia (through October 17) More than 30 prints by the Japanese printer and print artist based on his travels in India and Southeast Asia.

FREER GALLERY OF ART

A Breath of Spring (through January 9, 2000) Exhibition of a 14th-century Chinese handscroll painting, recognized as one of the greatest examples of pure-ink painting.
Arts of the Islamic World Paintings, calligraphy, glass and ceramics.
Shades of Green and Blue: Chinese Celadon Ceramics Forty-four works illustrate the development of the glaze.
Masterpieces of Chinese Painting (through January 30, 2000) Calligraphy, handscrolls, hanging scrolls, murals and screen paintings—some of the great works for which the Freer Gallery is known worldwide.

NATIONAL PORTRAIT GALLERY

Picturing Hemingway: A Writer in His Time (through January 2, 2000) An exhibition of paintings, pictures, first editions, manuscripts and memorabilia marks the 100th anniversary of the author's birth.
Edward Sorel: Unauthorized Portraits (through January 2, 2000) Satires and witty spoofs of 20th-century celebrities by the award-winning caricaturist.

NATIONAL ZOOLOGICAL PARK

American Prairie The recently opened re-creation of the ecological system of the North American prairie includes prairie dogs, bison and other grassland animals and plants.

EXHIBITION CATALOGUES

Catalogues for most exhibitions may be purchased in the respective museum shops. Publications currently available include: *Picturing Hemingway* ($35 cloth) ◆ *The Nixon Years 1969-1974: White House to Watergate* ($29.95 cloth) ◆ *Ainu: Spirit of a Northern People* ($39.95 paper) ◆ *Edward Sorel: Unauthorized Portraits* ($40 cloth, $25 paper) ◆ *Wrapped in Pride: Ghanaian Kente and African American Identity* ($80 cloth, $45 paper)
To order, send check or money order to Smithsonian Museum Shops, 8308 Cinder Bed Road, Lorton, Virginia 22079. Include 15 percent of purchase price for postage and handling (minimum charge, $4.50).

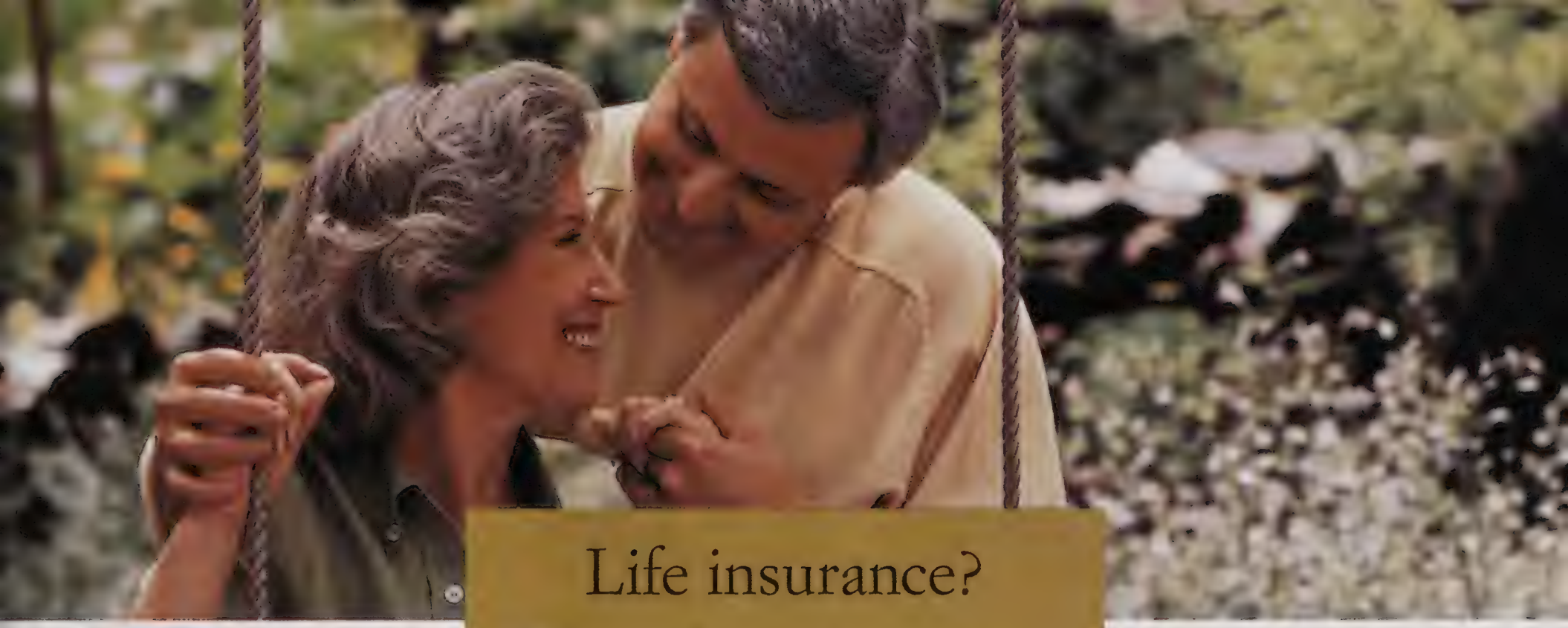
SMITHSONIAN INSTITUTION TRAVELING EXHIBITION SERVICE

Each year, SITES circulates exhibitions to more than 250 venues throughout the United States and abroad. To sponsor a show in your community, write SITES, Smithsonian Institution, Washington, D.C. 20560. A listing of exhibitions is available at www.si.edu/sites. Here is a selection for the month of September:
**This Land is Your Land: the Life and Legacy of Woody Guthrie* is on view at the Autry Museum of Western Heritage in Los Angeles through September 26.
**Star Wars: The Magic of Myth*, originally shown at the National Air and Space Museum, will open for its national tour at the San Diego Museum of Art on September 25.
**Women of Taste: A Collaboration Celebrating Quilt Artists and Chefs* premieres at Silver Dollar City, a theme park in Branson, Missouri, on September 4.

Planning a Smithsonian Visit?

THE CASTLE—INFORMATION CENTER

Begin your visit at the Associates' Reception Desk in the Castle's Smithsonian Information Center—open 9 A.M.-4 P.M. daily. Special materials and information on exhibitions, activities and dining are available there. Learn what's new at the Smithsonian and about other area attractions—with brochures, videos, touch screens, electronic maps and more. Smithsonian museums are generally open 10 A.M.-5:30 P.M. daily, except December 25. To receive a free Associates' planning packet, write to Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560-0010, or send your request via e-mail to info@info.si.edu, or call 202-357-2700 (voice) or 202-357-1729 (TTY), 9 A.M.-5 P.M., Monday-Friday; 10 A.M.-4 P.M., Saturday-Sunday. Note: Parking on the Mall is limited; Metrorail is convenient to most museums.



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*In this example, MoneyGuard pays up to $150 a day for home health care, nursing home care or assisted living, or up to $75 a day for adult day care.

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Saving Birds with a Ring and a Prayer

BY SCOTT WEIDENSAUL

IN NORTH AMERICA, MORE THAN 60 MILLION BIRDS HAVE BEEN BANDED TO HELP US LEARN HOW THEY LIVE AND TRAVEL

PHOTOGRAPHS BY CAMERON DAVIDSON

IN THE APPALACHIANS OF EASTERN Pennsylvania, there is a bite to the wind in October, a no-nonsense chill that notifies humans and animals alike that the seasons are turning, and fast. Not coincidentally, those winds also carry a flood tide of hawks, eagles and falcons that migrate down through the mountains—and each autumn morning, on a rocky ridgetop miles from the nearest road, I spread my nets to meet them.

Half an hour after daybreak, the wind is already rising, promising a good flight, as I open the nets. There are three of them, arranged in a triangle, each 40 feet long and nearly 8 feet high, made of a fine, almost ethereal mesh, soft as spider's silk and nearly invisible. A hawk, striking the net, drops into one of the billowing, horizontal bags of mesh that run its length, becoming harmlessly entangled.

I help that process along with a bit of deceit. Sitting inside the net triangle, protected (just in case) by a leather flak jacket, is a domestic dove, just the right size prey for a small, hungry hawk. By twitching a line that runs from the lure back to my wooden blind 30 yards

A banded ruddy turnstone is released on Delaware Bay in a study on the impact of ecological changes on shorebirds.

away, I can make the dove flutter a bit—all that is necessary to catch the sharp eyes of a hunting raptor.

That's exactly what happens just a few minutes after I open the nets and return to the blind. A sharp-shinned hawk, an agile woodland species not much bigger than a blue jay, comes skimming down the ridge like a radar-evading jet; even before I tug the line, it spots the dove and changes its flight path, rocketing down toward its erstwhile meal and smacking into the middle of the net. Unable to move, the hawk chitters in anger, while the bored dove, a veteran of many seasons, goes back to pecking at its food.

Grabbing the hawk by its long, yellow legs, careful to keep the needlelike talons away from me, I quickly slip it from the net and carry it back to the blind. Around its right leg I close a lightweight metal band, stamped with a serial number and an address; the band is loose enough to move easily so it doesn't chafe, but the hawk won't be able to remove it. After weighing the hawk, recording its age and gender, and taking a series of measurements, I release it—now part of the world's largest, longest-running study of wild animals and one of the most effective cooperative research projects ever undertaken.

The hawk spots the lure, changes its flight path and rockets down, smacking into the net.

How does a scientist learn about a wild bird, when—to our eyes, at least—one individual of a given species looks like every other one? The solution, as John James Audubon figured out, is to mark the bird somehow. Around 1804 the young naturalist experimented on a nest of eastern phoebes he found on his father's estate near Philadelphia. "I fixed a light silver thread to the leg of each, loose enough not to hurt the part, but so fastened that no exertions of theirs could remove it," Audubon wrote. The following spring, the marked phoebes returned, proving his hunch that birds may come back to their birthplaces.

Though Audubon was probably unaware of it, people had been marking birds since the early days of the Roman Empire, learning about their movements quite by accident. There is an anecdote about Henry IV, the French Bourbon king, losing one of his trained peregrine falcons around 1595, and the marked bird showing up the following day on the Mediterranean island of Malta. Gray herons were marked with anklets (for reasons unknown) in the late 17th and early 18th centuries, including one found in 1710 in Germany carrying a leg ring from Turkey.

But organized, scientific bird banding, applied intentionally as a tool of research, did not begin until 1899, when a Danish schoolteacher named Hans Christian Mortensen crafted his own metal bands, inscribed with his name and address, and placed them on 165 young starlings; later he expanded his work to include waterfowl and hawks. When Mortensen's birds began popping up elsewhere in Europe, other ornithologists across the Continent began to copy his technique, and by 1902 "ringing," as it is still known in Europe, had crossed the Atlantic. In that year, Smithsonian biologist Paul Bartsch began the first North American scientific system of bird banding when he ringed 23 black-crowned night herons with aluminum tubing inscribed with the date, serial number and the words "Return to Smithsonian Institution." By 1909 there were so many banders working in the United States that they formed the private American Bird Banding Association, but the scheme suffered from a lack of overall coordination and standardization among the many banders taking part.

Finally, in 1920, responsibility for coordinating the research passed to the federal government, whose Bird

Opposite: A pigeon, protected by a leather flak jacket, lures hawks to a net. This page: Two sharp-shinned hawks (left), a red-eyed adult and a yellow-eyed juvenile, are banded and released (below) by the author at his bird banding station in eastern Pennsylvania.

Banding Laboratory (BBL) in Maryland is now under the auspices of the biological resources division of the U.S. Geological Survey. In close cooperation with the Canadian Wildlife Service, the BBL serves as the clearinghouse for all North American banding data collected. Today, almost 6,000 banders across the United States and Canada—some of them scientists but many, like me, interested amateurs—work to solve the mysteries of bird biology, ecology and migration. (Because it is against the law to catch wild birds, banders must be licensed by the federal government, which demands a high degree of training from applicants. Some states require additional permits.) Most banders come up through the ranks, as I did, by volunteering for years with someone who already has the proper permits.

Banding is exciting, but at its core is science. Thanks to a century of scientific banding—to take just one example—we know that sharp-shinned hawks, like the one I caught, migrate to the Gulf Coast and beyond, to Mexico and Central America; that juveniles often fly along the coast their first year but learn as they get older to take a shortcut down the Appalachian Mountains; that they usually return to exactly the same nesting and wintering location year after year; that more than three-quarters of all the young hawks die before their first birthday, and that those who survive live an average of just four or five years—up to nine if they are very lucky. Such information is obviously essential if we are to learn more about the conservation and management of wild birds.

"Almost everything we know with certainty and precision about bird migration has been discovered or proven through banding," ornithologist Jack Connor asserts in his book *Season at the Point*, "and it is not an exaggeration to say that the numbered leg band has been as important a tool in the science of avian migration as the telescope has been in planetary astronomy." The same could be said for almost every other aspect of bird biology and ecology, from habitat selection to mate fidelity. So banders like me take a great deal of professional satisfaction from the work, but there is something more, too—a wonderful sense of privilege, curiosity and humble awe that comes from working so intimately with wild birds, be they tiny hummingbirds or massive eagles, many of which make globe-girdling migrations of stunning duration. If anyone ever finds that banded hawk of mine—hit along a road or dead from striking a window, for example—and if they write to the BBL or call its toll-free line at 1-800-327-BAND to report the serial number, another tiny chink in our knowledge of birds will be filled in. The odds of that happening are slim, though; for most species, only 1 or 2 percent of banded birds are ever reported, which is why banders play a numbers game, always hoping that the next bird will bring the jackpot.

In the years since scientific banding began in North America, more than 60 million birds, representing virtually all the hundreds of species found on the continent, have been banded. (The only thing the government supplies are the bands—all the rest of the equipment, including mist nets that can cost hundreds of dollars each, are the responsibility of the banders.) Every year, another 1.2 million birds are ringed.

In turn, more than 3.3 million bands have been found and reported over the years: by hunters who shoot ducks

and geese; by average folks who hear a thump and find that a banded songbird has flown into their picture window; and by other banders, often years after the ring was first affixed. A friend of mine banded a red-tailed hawk in Pennsylvania in the 1970s, released it, and forgot about it—until it was recaptured by another bander more than 22 years later, still hale and hearty, making it the oldest of its species ever recorded in North America. Researchers working with albatrosses must sometimes replace old, worn bands that, while rugged, have a shorter life expectancy than that of the birds, which theoretically can live up to 80 years.

Over time, recoveries build a jigsaw-puzzle map of how birds live, where they travel and how long they survive. In the 1920s, banding helped scientists piece together the 22,000-mile annual migration of the Arctic tern, which travels the Atlantic nearly from pole to pole; more recently banding showed that some shorebirds make a 3,000-4,000-mile, nonstop northbound flight from Brazil to the mid-Atlantic coast each May. Thanks to banding, we know that some birds leave the hemisphere entirely, like one pintail that was banded in Louisiana years ago. The duck eventually flew to China, far off its usual migratory path, where a farmer named Cheng Jin-fa found it. "I feel very glad to wrote you. I did not know you and you did not know me," Cheng wrote to the BBL. "Who introduced I to you? It is your pigeon. She Flew To China. What a far way she flew! It is marvelous." It was indeed.

Tundra swans scramble out of a temporary holding pen in Pennsylvania after capture for banding. Researchers want to determine where the swans breed each summer.

SCOTT WEIDENSAUL

Before any of this can happen, of course, it is necessary to catch the bird. Banders have employed an arsenal of gizmos and techniques—some elegant, some Rube Goldbergian—to turn a bird in the bush into one in the hand. There are elaborate box traps, drift fences, funnel traps, foot snares, spring-loaded clap nets and a hundred other devices, but the vast majority of birds, especially songbirds, are caught using mist nets. Invented in Asia, today's nylon mist nets are so effective that their use is illegal in most countries unless one holds a valid banding permit, and manufacturers have finally been pressured into not selling them on the open market, where bird sellers and poachers can buy them.

Some capture techniques are a bit more, well, muscular. Before dawn on a frigid March day, with a 20-below windchill and blinding snow squalls, I crouch in a pit blind with field technician Jack Gilbert and biologist Mary Jo Casalena, of the Pennsylvania Game Commission (PGC). We have spread corn to lure flocks of tundra swans out of a nearby pond and within range of a rocket net—a 100-by-70-foot expanse of heavy fishing mesh attached at its corners to metal weights and launched by explosive charges through the air over the feeding birds.

Thousands of tundra swans winter along the lower Susquehanna River, but no one is quite sure where they come from; perhaps Canada's Northwest Territories, perhaps Alaska or even eastern Siberia, PGC wildlife biologist

John Dunn tells me the day before. This banding project, an attempt to learn more about the swans' survival rates and migratory routes, is a cooperative venture between Pennsylvania, Virginia and North Carolina, the states where most of the swans winter.

It takes hours for the swans to leave the refuge of the lake, but eventually they move onto shore, picking at the trail of corn. Mary Jo sits tense, poised to fire the charges by touching the wire leads to a battery, while Jack watches the birds, ready to give the signal.

"OK, any minute, let's just wait until all the heads are down—hold on, something spooked them," Jack hisses. Every swan's head is at attention. The fast-moving net can be dangerous, and the biologists want to pick a moment when the flock is feeding.

"What do we do when you shoot the net?" I ask.

"It's pretty simple," Mary Jo says quietly. "Run like hell and tackle any bird that looks like it's going to get out."

"All right, as soon as the wind stops for a second," Jack says, interrupting us. The roar outside subsides for a moment. "OK, now, now!"

There is a loud explosion, and the net flies on a low, nearly horizontal trajectory, trapping dozens of swans. I fling back the blind roof and scramble up the short ladder, my cold-numbed legs barely working. Mary Jo and I pelt across the snowy field toward the trap, where swans are thrashing wildly. Several of the birds escape before we reach them. I skid to my knees, pinning one swan seconds before it works free, and Mary Jo straddles across several more, holding them in place, as Jack comes up with the gear.

Fortunately, there are reinforcements handy—John Dunn and the rest of the swan crew have been watching from their trucks some distance away, and within minutes they pull up, assemble a portable corral that looks like a large playpen and transfer the 15 birds we still have from the net. The banders form an assembly line, each person kneeling and gently folding a swan's head under its wing, then checking its vent to see if it is male or female. Dunn crimps a large, silvery band to one black leg, and then the swan goes back into the holding pen. When everything is finished, the researchers simply pull away one wall of the pen and the swans stampede back to the pond.

I can't help but wonder if one of those swans will be found by an Inuit in Canada, or a Chukchi reindeer herder in Siberia, and if the report will eventually reach the BBL in Laurel, Maryland. This year, the BBL has already fielded more than 80,000 band reports (that number does not include pigeon bands, which the BBL does not track). Most come by mail, telephone and, increasingly, the Internet. But the lab's history is full of stories like the one in 1944, when the U.S. Embassy in Peru forwarded the numbers from 13 chimney swift bands that they'd received from Indians on the remote Río Yanayaco—thus finally solving the mystery of where the swifts go in the winter.

Once, all bird bands carried an abbreviated version of the lab's address, but in recent years, the 800 number has been phased in, slowly replacing the address on most of the bands. This has dramatically increased the number of reports from the public.

"This year, at least 75 percent of band recovery reports are coming in by phone," says BBL chief John Tautin, as he leads me among cubicles where clerks chat with callers, tapping the information directly into the computer. "On the phone we can ask specific questions about how, when and where the banded bird was recovered—the information most important to the banders. Then we send the caller a certificate of appreciation along with information

and additional background about the banded bird," he says.

Bird banding even has its own urban legend, a 70-year-old misprint that has gained new credence, thanks to the Internet. Last year, several newspapers and wire services reported variations on the following tale, which was circulating widely on the World Wide Web: the government, they claimed, had changed the inscription on bird bands from "Wash. Biol. Surv."—an abbreviation for Washington Biological Survey—because on some bands "Biol." was misspelled as "Boil." A camper (sometimes a hunter or a farmer) supposedly wrote to say that he found a crow (or a coot or a vulture) wearing the band, followed the directions to wash, boil and serve, but the bird still tasted horrible. Tautin tried to track down the origin of the story and found that in the 1920s a batch of bands did indeed carry the misspelled abbreviation. While some banders at the time were afraid folks might misinterpret the inscription, Tautin can find no evidence that anyone actually did.

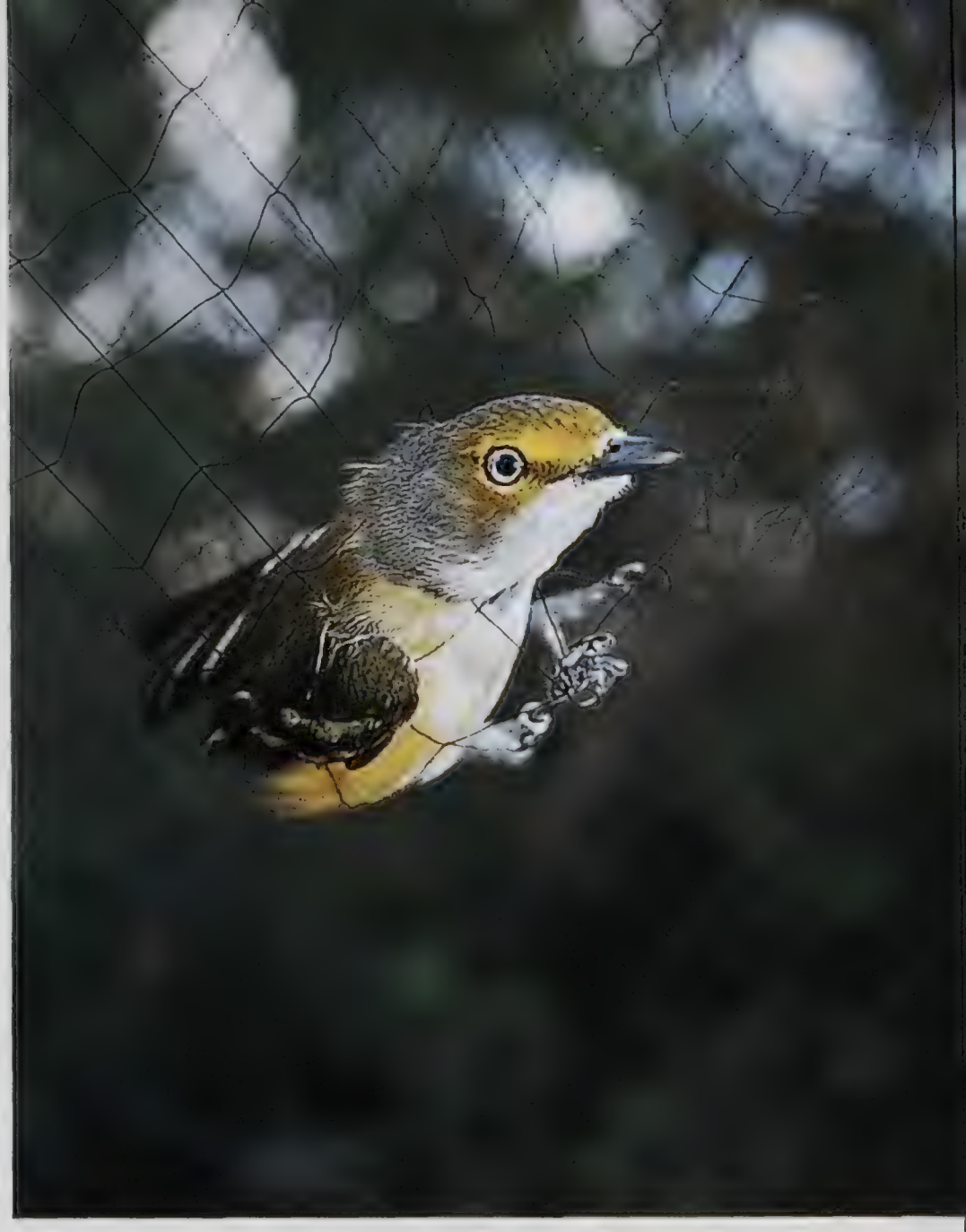
In the past, the majority of banders were interested amateurs, like me, but today, three-quarters are affiliated with universities, government agencies, conservation groups or consulting firms. "It's a pretty good cross-section of society," Tautin says. "But there are still lots of what I call avocational banders. They may not be professionally trained ornithologists but are professional in their operations. Bob Sargent is a good example—yet he's an electrician."

I've known Bob and Martha Sargent for several years, and Tautin's endorsement is all the excuse I need to join them again at their Fort Morgan, Alabama, banding station. They and their crew of more than a dozen volunteers monitor an array of nearly 60 mist nets, strung along narrow lanes that wind through the pines and live oaks. Each spring and fall for 13 years, the Sargents have been banding here, helping scientists understand why the complex interaction of geography, weather and blind instinct makes the northbound migration of songbirds possible.

This banded bird may produce the final piece of information for solving a scientific mystery.

Located on a sliver of land that juts out into Mobile Bay, Fort Morgan can be a godsend for tiny birds that have just flown some 600 miles across the Gulf from Mexico—especially if they collide with a cold front and northerly headwinds halfway across, as often happens in the spring. Then the trees fill with warblers, vireos and dozens of other species, and so do Bob and Martha's mist nets.

My first day is fairly good—nothing amazing by the standards of the Gulf Coast, where the forest can drip with an eye-popping number of birds. Teams of two or three banders head out every 15 minutes to check the nets, slipping each small bird into its own mesh drawstring bag. There is a real sense of anticipation to this job, never knowing what the next net will hold—maybe a yellow-billed cuckoo that growls and grumbles, or a prothonotary warbler that shines like gold. Here and there we encounter birders, curious tourists or swarms of grade-schoolers, for the Sargents encourage visitors.



In Fort Morgan, Alabama, a white-eyed vireo (left) hangs in a net. The painted bunting (top right) and indigo bunting (bottom) may be declining species, so tracking them is urgent business.

Back at the banding station, at a couple of tent pavilions set up in the shade, Steve Wakeham, a "ringer" on a working holiday from England, reaches into a bag. He extracts a male painted bunting—a stunning bird with a cobalt-blue head, giving way to scarlet from throat to tail, with a chartreuse triangle on its back that glows like neon. The two dozen or so visitors surrounding the banding table gasp; for many of them, this is their first close encounter with a wild bird. Wakeham affixes a tiny band with special pliers and begins a series of measurements: the length of the tail, wing and bill, the amount of fat deposited beneath the skin. Such minutiae may help experts puzzle out regional population differences, among other riddles.

Time and again, the magic of the songbirds dazzles

everyone. A white mesh bag produces a black-throated green warbler the color of ripe limes, or an orchard oriole, all chestnut and black, and the crowd collectively draws its breath and pulls closer, unblinking. But this is gravy; the real magic, which is invisible, is just about to begin—the long, slow, unpredictable process by which this banded bird may produce the final piece of information for solving a scientific mystery. Or (and this is much more likely) the bird may simply vanish forever into the vast anonymity of nature.

As the day drags on, the number of birds steadily dwindles. When we open the nets at 5:15 the next morning, the woods are silent, except for the hurried calls of chuck-will's-widows in the shadows. Most of the songbirds, having grabbed a quick bite and some rest, took off after sundown for another nocturnal flight north. Bob Sargent, a tall, solid man nearing what most folks would consider retirement age, moves quickly in the dark, adjusting the delicate nets with the help of longtime volunteer Fred Moore.

"Gonna be a slow day, Bob," Fred says as they open a net. "Sounds like everything pulled out last evening."

"Yeah, it'll be slow this morning. But I like that wind," Bob replies, cocking an eye at the tops of the pines, whipping in a stiff north breeze. Both men know that if large flocks of birds left the Yucatán Peninsula last night, they'll be weary and hungry from muscling against the wind when they make landfall later in the day.

At first, though, it seems that Fred's prediction is coming true. We catch a smattering of songbirds in the early hours of daylight, but the pace slacks off quickly. By midafternoon, somnolent volunteers doze, read or work at puzzles on the banding table, the pliers and strings of bands pushed to one side. Fred, slouched in a lawn chair, looks dead to the world—but at 3 o'clock he snaps awake, looks around and says, "Kingbirds!"

We hear them, too, suddenly—dozens of them chattering their buzzy calls, alighting in treetops that had been empty and lifeless all day. Strong, fast fliers, the kingbirds are the vanguard of the Yucatán Express (as birders call the daily flights), having left Mexico at sunset the previous evening and flown more than 20 hours into the teeth of the gale to get here. Minutes later, flocks of orioles arrive, with lots of tanagers in the mix, and the first of what proves to be wave after wave of thrushes. The newcomers keep arriving until well after dark. Smaller birds have a harder time overcoming the wind and consequently take even longer to make the crossing.

The next morning we are overwhelmed by birds—we return from each round of net-checking burdened by 20 or 30 squeaking, gently twitching bags, and Bob works feverishly for hours without a break, banding, weighing and measuring each in turn, averaging two birds a minute. Having just applied a band to a male ruby-throated hummingbird, he weighs it on a digital scale—2.61 grams, down from the normal weight of about 3.2 grams. "This bird has been flying for almost 20 hours across the Gulf, and it's used up all its fat and about 10 percent of its muscle tissue," Bob says; the hummer laps hungrily at sugar water offered from a syringe. But in the bug- and nectar-rich coastal forest, it should be able to recuperate quickly and continue north.

By the time we band the last migrant of the day, a Swainson's thrush, the tally stands at more than 800 birds, and we all move with exhilarated weariness. But the Sargents and other banders don't work themselves to exhaustion for fun or idle curiosity. There is compelling evidence from radar studies that suggests the frequency of large flights of songbirds across the Gulf has declined significantly, perhaps by as much as 50 percent, since the 1960s. (Monitoring projects like the North American Breeding Bird Survey, on the other hand, show that while some species of songbirds are in steady, widespread decline in the East, others are stable or even increasing.) Long-term banding stations like the Fort Morgan operation provide one of the few snapshots of the migratory passage, and the capture totals

Moving quickly, banders (left) remove shorebirds from a cannon net along the New Jersey coast. A red knot (above) is weighed. A bander (below) closes the numbered band around the leg of a ruddy turnstone.

from year to year may hint at overall population changes.

Increasingly, banders are being called on to provide the hard data that conservationists and wildlife managers need to make informed decisions about how to protect migratory birds. Besides leg bands, they are employing other techniques: colored bands and markers for visual tracking; sophisticated transmitters that beam the birds' precise location from anywhere in the world to satellites; and laboratory breakthroughs such as DNA sampling and the study of stable chemical isotopes in a bird's feathers, which may help identify regional populations.

For many birds, the clock is ticking, giving banders a sense of urgency. Each May, for instance, up to a million shorebirds descend on the beaches of Delaware Bay to feed on the eggs of spawning horseshoe crabs. Some, like red knots, have just flown from the southernmost reaches of Argentina, including a 3,000-4,000-mile leg from the north coast of Brazil that takes them three days of nonstop flying. More than 80 percent of the knots in the Western Hemisphere funnel through the bay, as well as large percentages of several other species. They are close to starvation when they arrive—yet they must double their weight within a few weeks and make another 2,500-mile nonstop trip to the Arctic, where they breed. The fat they put on along Delaware Bay is absolutely crucial to the success of the breeding season, carrying them through the first days of courtship and egg-laying.

"If they don't get to the Arctic by the first week of June, lay their eggs by the second week of June and hatch their chicks by the end of June or early July, they lose that very narrow window of opportunity," says Clive Minton, an internationally respected shorebird biologist with the Victorian Wader Studies Group in Australia. "If they miss it, they might as well have stayed in Tierra del Fuego, because the whole 9,000-mile journey was wasted effort."

That's exactly what Minton and other researchers who study the epic journeys of shorebirds fear is happening. In recent years, commercial fishermen have taken millions of crabs from the bay for use as eel or whelk bait, leading to a 90-percent reduction in the number of eggs available to the birds. This year, Minton and a team of banders are following the migration of the red knots from South Amer-

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ica to New Jersey and Delaware, then on to the Arctic—banding, color-marking and radio-tagging the birds in a desperate effort to learn how reductions in the crab population are affecting the migrants.

At Cook's Beach, just north of Cape May, New Jersey, Minton and his crew crouch behind a dip in the sand as hundreds of knots, ruddy turnstones and sanderlings crowd into a patch of beach where spawning crabs left a thick deposit of eggs—one of the few good patches of food this year, it appears. What the birds don't know is that we've laid a trap. With a sudden boom, the banders detonate a cannon net, and in seconds, about 500 shorebirds are harmlessly trapped, as we all charge across a shallow tidal creek to quickly reach them.

Bands to fit any bird leg, each with its own number, are ready to travel.

The scene is one of orchestrated mayhem; while some people stretch swaths of burlap over the net to shade the birds as we remove them, others race about setting up banding equipment, a windscreen and burlap holding pens for the birds. The rest of us work as fast as possible to disentangle the peeping, chattering red knots and other shorebirds from the net. A few of the birds have already been banded and color-marked—their long legs sport a combination of small plastic rings, designed to be easily seen through binoculars. Above their "knee" joints, these birds also have a short plastic tab, known as a flag—orange if they were banded in Argentina, blue for those banded in Brazil, and green for birds banded in the United States.

When I show the bird to Minton, he is stunned. "My God, that's a Brazilian bird from 15 years ago!"

We set up a rapid-fire assembly line: some of us band birds with a numbered BBL ring, then pass them to another worker who weighs them. Because these knots arrived within the previous 24 hours or so, they are as much as a quarter below their normal, fat-free weight; in the weeks ahead, many will be caught and weighed again, permitting researchers to precisely track the pace of fat accumulation. Finally, a volunteer takes the knot to another cluster of researchers for color-marking and release. The combination of green flag over red band on the left leg and metal band over green on the right will forever mark the bird as one banded in New Jersey in 1999.

Tracking how long the shorebirds stay on the bay, whether or not they move around between feeding areas and how quickly they gain weight after arriving will tell fisheries and wildlife managers whether the heavy crab harvests are taking a toll on the birds. The banding, coupled with intensive follow-up counts along the coast of the bay, will also help accurately determine the hemispheric population of knots, which seems to be half the numbers estimated in the 1980s. All the research seems to point to one inescapable fact, Minton contends. "The Delaware Bay isn't just a good place for knots; it's the one critical place on this entire flyway for the species," he says. But to safeguard the migrants and push for regional fishing regulations to scale back the crab harvest, "we must have facts—we can't just go on emotion or intuition."

One of the last knots I pull from the net that day, gingerly threading its long, narrow wings from the mesh, is already banded—and not with just any band, but one so old and worn that the serial number is almost unreadable. The thinning metal is pulling apart at the seam, so it is miraculous that the band is still on.

When I show the bird to Minton, he is stunned. "My God, that's a Brazilian bird from 15 years ago!" he says, recognizing the serial number that was used in that country by pioneering shorebird researchers. It is, as we later find out, one of the oldest red knots ever documented in the Western Hemisphere—a remarkable discovery, and just one more nugget of knowledge to banding's credit.

But at the time, I have no thoughts for research or science. The red knot, no bigger than a robin, sits quietly in my hand, staring at me with dark eyes. I try to grasp the fact that each year, for perhaps 15 years, this tiny creature has flown nearly 18,000 miles, from the most northerly land in Canada to the most southerly point in South America and back again—as much as 270,000 miles since it was last held by a human, a distance from here to the moon and partway home.

All I can do is shake my head with mingled awe and respect for the travelers that stitch together this wide world—and say a silent prayer that they will still grace the skies long after we're gone.

Scott Weidensaul's latest book is Living on the Wind: Across the Hemisphere with Migrating Birds *(North Point Press). Cameron Davidson's photographs on our obsession with lawns appeared in April 1999.*

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Will the KITCHEN PLEASE SHUT UP!

TALKING OVEN MITTS, ANYONE? AT THE COUNTER INTELLIGENCE PROJECT, RESEARCH WIZARDS ARE CREATING THE CULINARY GIZMOS OF TOMORROW

IN THE KITCHEN-OF-THE-FUTURE AT THE MASSACHUSETTS INSTITUTE of Technology (MIT), I meet the Talking Oven Mitt. It looks like any oven mitt. But when its inventor, Ted Selker, holds it under a high-intensity lamp to simulate putting it into a hot oven to check on a cooking chicken or cake, it speaks in a reedy transistor voice.

"Hot and ready to eat!" says the Talking Oven Mitt. When Selker continues to hold it under the hot lamp, the oven mitt speaks again, urgently: "Fire!"

Selker, currently a visiting professor at the MIT Media Laboratory, is a top IBM researcher. He invented the red keyboard button for controlling an IBM laptop computer's cursor. He is also a mountain climber, recently returned from a scientific expedition up Mount Everest. At the moment, however, he is helping with the Media Lab's futuristic kitchen project, called Counter Intelligence. He unsnaps the Talking Oven Mitt's lining to show me its computer-circuit brain.

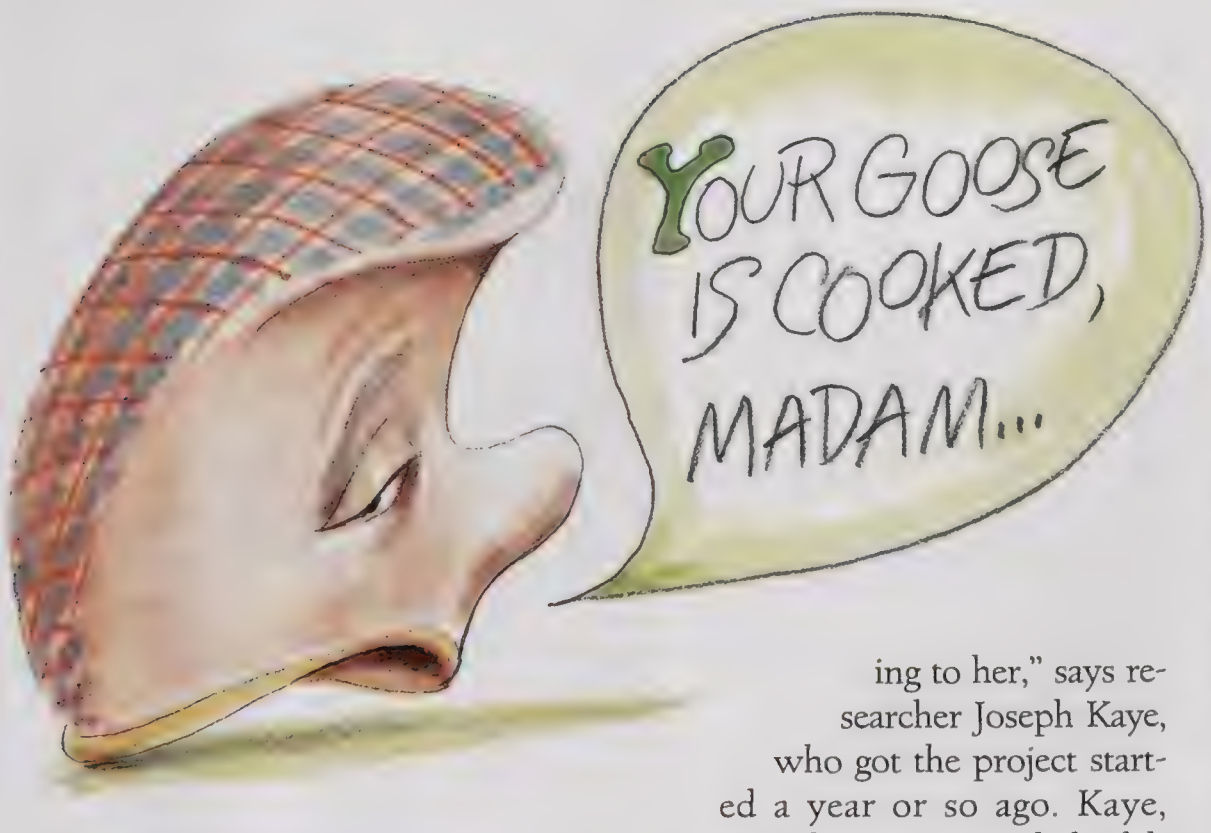
"It knows it was 200 degrees ten minutes ago, and now it's 320 degrees, and it can calculate the thermal mass. Just with thermometers and time I can model the whole cooking process!" he says. "All that with a common object that doesn't add junk to my life because I have to use it anyway!"

Selker brims with ideas, such as a pH meter, which measures acidity or alkalinity, to indicate when meat has gone bad. "Also, if I'm making a salad dressing, it can say, 'mild,' 'getting spicy,' or 'sour,'" he says. He is working on a salt detector, too, to help sodium watchers. It might be embedded in a spatula. "I'm also designing a breakthrough coffeemaker," Selker confides. "It will make the best coffee ever!" Who knows, maybe the cheeky machine will even talk.

Lifestyle guru Martha Stewart sometimes drops in at the Cambridge lab to check on the high-IQ-kitchen developments, such as a "smart" countertop that is just getting the hang of making peanut brittle. And it seems I am not the only person unnerved by kitchens that vocalize. "She said she absolutely did not want her kitchen ever talk-

BY RICHARD WOLKOMIR

ILLUSTRATIONS BY WALLY NEIBART



It looks like any oven mitt, but it speaks in a reedy transistor voice: "Hot and ready to eat!" When its inventor holds it under a hot lamp, it speaks again, urgently: "Fire!"

ing to her," says researcher Joseph Kaye, who got the project started a year or so ago. Kaye, who is known around the lab as the "Englishman with long hair," can accept that there could be an audio-off switch, he tells me. But the kitchen of the future *must* speak its mind. "It could still project things up on a wall," says Kaye.

This is the MIT Media Lab, after all, where the creation of "enabling technologies for learning and expression by people and machines" is the mission. Smarty-pants machines that express themselves are not Martha Stewart's thing. She has built an empire on creating beauty in daily life, along the lines of peony blossoms floating in pretty bowls. Still, efficiency is good. It can give you more time for cultivating peonies. And so, Martha Stewart has offered the MIT project such ideas as a cabinet drawer that not only stores dishes and tableware, but also washes them.

On one of Martha Stewart's recent visits, the researchers used their new laser cutter, which can slice a bagel or write messages on fruits and vegetables, to present her with a special gift—a photograph of herself engraved on an eggplant. It seemed to go over well. "She loved it," says Joseph Kaye. "It looked really good, too, the way the image blended with the color of the eggplant."

One of the project's directors, Michael Hawley, explains that, at this early stage, the researchers entertain all ideas—no matter how outlandish—to see where they lead. But, overall, the plan is to embed a kitchen with sensors and computer chips, connecting all the appliances, even the countertops and cabinets, to one another and to the Internet. It will be a brave new world, and kitchens will be just the start. "One of our researchers is working on a pill that contains a radio transmitter and a thermometer that continually measures your core temperature and radios it to your belt buckle," Hawley tells me casually.

Such concepts seem normal at the MIT Media Lab. Through this building wander about 400 geniuses (and, in many cases, their pet dogs), hunting for new technological notions to think really hard about. Here they refer to the ordinary physical world as "atoms." And they refer to the physical world's halo of increasingly digitized information as "bits." They see themselves as Daniel Boones on the frontier where "atoms meet bits." They are working on such notions as computers woven into the fabric of your clothes or curtains or tablecloth. But I feel like a real atoms guy lost in a bits world when I read a listing of their current projects and come to "quantum computing," in which "an ordinary liquid—like a cup of coffee—could harness natural forces so effectively that it would turn today's largest supercomputer into a digital dinosaur."

My own coffee is dim-witted. But I am not inexperienced in kitchens. I have thumbed through recipe books trying to put together a menu for the week. I have spent many a predinner hour listening to tapes of Elvis Presley and Buddy Holly while slicing carrots and frying soyburgers. And I have come to the Counter Intelligence project with a list of things I would like fixed.

"Let's see your list," says Michael Hawley, who is not exactly the kind of guy to whom I would automatically entrust my kitchen's evolution. For one thing, I question whether he has done much kitchen duty himself. How could he find the time? Besides being a principal investigator for one of the lab's three main research areas, Things That

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PHOTOS TAKEN BY BRAD HARRIS WITH KODAK ELITE CHROME EXTRA COLOR 100 FILM

Through this building wander about 400 geniuses (and their pet dogs), hunting for new technological notions. They see themselves as Daniel Boones on the frontier where "atoms meet bits."

Think, Hawley—who has a red beard and gold-rimmed glasses—has been a member of the U.S. National Bobsled Team and a luger. He was a New Jersey state yo-yo champion. He worked on "graphical interfaces for audio and musical applications" at Paris' Pompidou Center; he helped Lucasfilm develop the digital special effects now used in such movies as the new *Star Wars* series, and he was a principal engineer for Steve Jobs' post-Apple enterprise, Next computers. He also is a world-class pianist. "I've been doing my practicing in hotel lobbies on several continents," he reports cheerfully.

If this guy has time to pour Rice Krispies into a bowl, I'd be astonished. Nevertheless, he applies himself to my list with an air of unassuming competence. "'Not overcooking pasta or meat while you are doing three other things at the same time.'" Hawley is reading from my notations of kitchen grievances. "That's a hard one," he says. "It's quite difficult to fully understand the temperature of ingredients and express that information, but we're working on it."

"'What to have for dinner, coming up with a menu week after week'—yes, we're working on a recipe database, and then the system would coach you through the cooking process."

"'Licking the measuring spoon and then realizing later that you have to use that spoon again,'" he reads. "We haven't thought of that, but one of our researchers is trying to build a spoon that can taste food and recognize the ingredients via the DNA."

From his desk, he picks up—no, I'm not hallucinating—a Furby, black with a yellow nose and pink ears. (At the Media Lab, he also directs a research effort called Toys of Tomorrow.) The creature babbles, presumably in the tongue of its native planet. "The goal is to remove digital technology from desk-size boxes and put it in something so tiny it can be embedded in anything, like this toy," Hawley says.

"Never invest in anything that eats or needs repairing."

– Billy Rose, Theatrical Producer

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On one of Martha Stewart's recent visits, researchers used their new laser cutter, which can write messages on vegetables, to present her with a gift —a photograph of herself.

He stares in bemusement at the Furby, which is uttering cute-sounding gibberish. "See, I can tickle it and it laughs," he says, and the Furby does indeed giggle. "This is just a $30 toy for kids, but in its little body it has 30 times more microprocessor memory than the Apollo Lunar Lander did." It turns out that once the Furby gets going, it is impossible to shut off. Eventually, if it receives no attention, it goes to sleep. But it is persistent, and for the remainder of our conversation it sits on the desk chuckling and muttering, which is what I'm afraid my future kitchen might do. But it could be worse. "You might have a computer in your shoe monitor your weight and blood pressure, and let you know if it goes up," Hawley muses.

Actually, I do not want to be nagged by my shoes. However, as Hawley puts it, "tech is starting to move into the world!" Ordinary things, like my refrigerator, soon will be connected to the Internet, he tells me. "Suddenly it will have a planetful of processing power!" And I think, hey, that will be some pretty amazing refrigerator.

Kitchens are the focus of MIT's effort to move computing into domestic life, because they are the home's hub. Until now, most research in information technology has focused on the office. "But offices have a fairly modest set of interactions compared to the kitchen, where you have recipe timing, guests arriving, food temperatures, ingredients and a lot of other complexities most of us take for granted," Hawley says. Also, smartening up the kitchen will require changes in other parts of society, such as supermarkets. It's possible that grocery stores could eventually disappear.

Hawley cites such Internet shopping ventures as Amazon.com, the cyberspace store. Short term, Hawley believes, supermarkets will get smart enough to eliminate checkout lines. The same sensors the MIT lab is now installing in kitchen cabinets and refrigerators will hum away in supermarket shopping carts, tallying your purchases as you walk along the aisles. And increasingly, Hawley says, supermarkets will be on-line, too. In fact, your kitchen itself will help keep your larder stocked. As Hawley explains it, the kitchen will automatically monitor the contents of its closets and refrigerator and then, via the Internet, reorder such basics as sugar and flour and paper towels, to be delivered to your house. "Who wants to march along supermarket aisles looking for paper towels?" Hawley says. He points out that on-line grocers, such as Peapod.com and HomeRuns, already let you order by e-mail.

"We are gravitating in the direction of eliminating work," Hawley continues, "but you don't want to suck the joy out of cooking, either. So what if the ingredients could talk? You might have a recipe database and software agents to talk you through the preparation—you'd put the stuff on the counter and the recipe would evolve." The researchers are also delving into nutrition. "We've built scales into the countertop that count the calories as you scoop ice cream into a bowl, and we've tried a game where you select ingredients and they describe themselves—a chicken appears on the screen and tells you its history," he says. It could be a learning device for children, he points out, or a way for adults to get a running account of the health aspects of foods they select.

Already the lab has created a microwave oven that reads the bar code on a package of food, weighs it and then "nukes" it just right. And researchers are

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"We've tried a game where you select ingredients and they describe themselves—a chicken appears on the screen and tells you its history." This could be a learning device for kids.

developing sensor-embedded personal magnets. You pull the magnet out of your pocket, stick it on the refrigerator, and the state-of-the-art fridge identifies you and plays messages that family members have transmitted via *their* magnets. "Refrigerators," says Hawley, "aren't really just for keeping food cold, because they're also a family message center." One student adapted a laser cutter, designed for building plastic models, to cut up food. "You could pick up a tomato that says 'Slice me six times and then you can dice the green pepper,'" says Hawley. "That's just fun, of course, but things will be a little more animated than in the world we live in now, because when you embed intelligence in things, they start to come to life."

He then reflects momentarily, while the Furby on the corner of his desk intermittently giggles. "I'm not saying you want cans of Campbell's soup jabbering to you on the shelf," he says. "But if you reach for a pot handle on the stove, it might exclaim, 'Watch out! I'm hot!'"

Martha Stewart, says Hawley, came up with the idea of a counter that becomes a cooking surface. Wherever you put down a pot, the heated circle automatically sizes itself to the diameter of the pot bottom. Lab researchers are now working on that. Hawley says they are looking into ways to grow herbs in the kitchen hydroponically. He expects food packaging—designed to attract your attention on the shelf and then pass easily through the checkout line—will change as people (and their robot kitchens) increasingly order their groceries on-line. In the future, packaging might talk. The lab has already created a "smart" package of Tide, the chip in the dot over the letter *i*. Someday such packages might answer your questions, such as how to get a ketchup stain out of your trousers.

But the lab has not yet solved what could be the toughest problem. "The most frequent request we hear is for a kitchen that cleans itself," Hawley says.

I head out from Hawley's office to see what the lab has wired up so far. I'm on my way to check out the experimental kitchen with Alexandra Kahn, who directs the lab's press office. Researchers are just beginning to figure out how to wire in its sensors and chips, and the smart kitchen is still evolving. One counter is strewn with a jar of unsalted dry-roasted peanuts, a bowl and a wooden spoon—both encrusted with dried peanut brittle—a yellow-handled screwdriver, a bottle of corn syrup, a bowl of dried navy beans, a circuit board, a package of English muffins, a braid of multicolored wires, a soldering iron, needle-nosed pliers, a package of flour, a jar of instant coffee, plastic boxes full of electronic components. Right now, the counter is learning to make peanut brittle. "Now add the peanuts," it says. When you pour nuts into the mixing bowl, it says: "A little bit more . . . a little bit more . . . and that's enough!"

We visit Mr. Java, which is an espresso machine that Joseph Kaye, the "Englishman with long hair," wired to a computer and sensing system. Kahn shows me the bottom of her personal coffee mug, to which is glued a radio frequency identification tag, or RFID, a technology the Media Lab believes will replace bar codes and bring all sorts of things to digital life. When she puts her mug under the espresso machine's spout, a sensor in the coffeemaker reads the data encoded on the mug's tag and produces just the brew she likes. "My tag says 'Alexandra likes latte, with extra milk,'" she tells me. While she waits for the latte to brew and pour, the machine tunes in the Internet audio choice encoded in her cup's RFID tag, National Public Radio. When Joseph

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Age	10 YEAR	15 YEAR	20 YEAR	25 YEAR	30 YEAR
35	$ 103	$ 125	$ 145	$ 183	$ 205
40	$ 123	$ 158	$ 185	$ 238	$ 260
45	$ 190	$ 215	$ 253	$ 330	$ 385
50	$ 253	$ 290	$ 363	$ 490	$ 495
55	$ 365	$ 413	$ 550	$ 835	$ 1,015
60	$ 503	$ 615	$ 845	$ 2,135	$ 2,400
65	$ 775	$ 975	$1,593	$ 3,900	$ 3,900
70	$1,338	$ 1,600	$2,970	$ 7,220	$ 7,220
75	$2,275	$ 4,870	$5,820	$10,370	$12,420

Male Premiums

Age	10 YEAR	15 YEAR	20 YEAR	25 YEAR	30 YEAR
35	$ 123	$ 138	$ 165	$ 223	$ 253
40	$ 148	$ 183	$ 225	$ 288	$ 335
45	$ 225	$ 300	$ 360	$ 450	$ 513
50	$ 338	$ 455	$ 525	$ 743	$ 828
55	$ 500	$ 670	$ 768	$ 1,640	$ 2,330
60	$ 783	$ 990	$1,335	$ 3,630	$ 3,630
65	$1,330	$ 1,650	$2,693	$ 5,250	$ 5,250
70	$2,473	$ 3,175	$4,860	$ 8,790	$ 8,790
75	$4,400	$ 7,443	$9,600	$13,260	$15,030

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The recipe is replaced with a grinning on-screen character in a tall chef's hat, who points at the sugar. He suggests you use low-fat chocolate—a suggestion you cheerfully ignore.

Kaye presents his cup to Mr. Java, he gets a double-tall latte and programming from a British radio service.

Kahn tells me that Starbucks, the coffeehouse chain, is looking at Mr. Java. In fact, the lab's Counter Intelligence research, which can seem to be about a far-off galaxy, is actually subsidized by such corporate giants as Kraft Foods and Unilever. For one thing, home appliances usually get replaced only when they wear out. Surely it would be attractive, from a marketer's viewpoint, to offer jazzed-up new refrigerators and washing machines with the latest must-have digital wrinkle, the equivalent of HDTV.

Now we are looking at a kitchen counter that is in the process of becoming highly intelligent. It is still in its early development stage, and seems to have a severe wire addiction. "Right now, it has a scale in one spot, but the whole counter could be a scale," says Kahn. She shows the bottoms of the containers marked "flour" and "sugar." Each has a glued-on RFID tag, which the counter can read. "As I'm making a recipe, pouring in flour or sugar, the counter will tell me when it's the right amount," Kahn says. "It can also record a recipe you're making up as you go along, so you can use it again," she says. "And other Media Lab researchers are working on an interactive system that goes into Julia Child's cooking archives to access a selection of recipes and instructions."

Kitchen Sync is one of the names researchers have given their project. To show how it will function, once it is wired and all of the appliances and cupboards are smartened up—and it has a voice—Joseph Kaye has created a scenario called "Chocolate Cake":

"Kitchen!" you announce, bringing Kitchen Sync out of its sleep. "I'd like to make a chocolate cake for dessert tonight."

"I'm afraid we're out of butter: the delivery was delayed. We can substitute canola oil though—you liked that last time."

"Fine."

The sounds of John Coltrane fill the air as you assemble the ingredients list projected on the wall, with the kitchen only occasionally advising you—like on where you last put the baking powder. You put a mixing bowl down on the counter, and look at the wall. The recipe is replaced with a grinning foot-high character in a tall chef's hat, who points at the sugar. You pick it up.

"Two and a half cups of sugar." You start pouring.

"One cup . . . two . . . then you put in a half . . . and stop."

You put the sugar back on the counter.

"You can put that away now. You won't be needing it. And it'll make the place tidy."

Guess you accidentally engaged the "Mother" mode. Still, you continue with the rest of the recipe, mixing and stirring. The kitchen reminds you of the substitution, and suggests you use low-fat chocolate—a suggestion you cheerfully ignore, despite a twinge of guilt as it updates the calorie count at the bottom of the image on the wall. It's only a matter of sliding the cake into the preheated oven and waiting until the kitchen reminds you to take it out. And if you're in the shower when that happens? No need to worry: your kitchen will remember to turn the oven off, even if you don't.

But we do not want to chat with just our kitchen. In the 1950s, say the lab's researchers, the average family spent more than an hour a day gathering, cooking, serving and eating food, and talking as they did it. Today, the figure is 16 minutes. As a lab report puts it: "Table talk, once a cornerstone of family life, seems to be a casualty of fast-food." Counter Intelligence researchers

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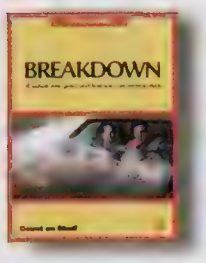

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"What are you making now?" Mom asks, her voice issuing from the VisiPhone. In the crystal ball, the spiraling lights turn blue, indicating Mom is speaking.

hope to help spread-out families get together again in the kitchen, although not necessarily physically.

Judith Donath, who heads the lab's Sociable Media Group, studies how technology can connect people. "So much research dealing with social technology focuses on the office, very little on our personal lives," she tells me. "So how can we bring kitchens that are in distant locations together? Or if your daughter is away on a business trip, for example, how can you have dinner with her?"

Speakerphones are one answer. But they would be awkward when people in the kitchen are silent, just slicing and mixing. Also, a disembodied telephone voice can be unsettling. Videoconferencing might help. But with current technologies you cannot move around freely. And your video image is apt to be looking—unnervingly—in odd directions.

Donath and her researchers are experimenting with a simpler technique: a stand-in for the physically absent visitor. She shows me the VisiPhone. Currently it is a knee-high black column topped by a dome resembling a halved crystal ball. Spiraling through the "crystal ball" are light blobs, something like a '60s lava lamp. These light blobs, at least for now, are abstract embodiments of the speakers—the person at a distance is represented by blue lights, the person at home by orange. Maybe realistic images will never be introduced into this scenario; not everyone wants to hear *and* see a virtual mom nagging away from a distance.

Donath and another researcher demonstrate how their system works. Let's say your mother, in Pasadena, is "visiting" your Baltimore kitchen. "What are you making now?" Mom asks, her voice issuing from the VisiPhone. In the crystal ball, the spiraling lights turn blue, indicating Mom is speaking. "Cupcakes," you say. Now the lights turn orange, showing that your words are being transmitted to your mom's VisiPhone in Pasadena. I am thinking, technological séance.

Waiting for my plane home, I have dinner at a seafood restaurant in the Boston airport. I am pondering talking kitchens and virtual visitors. I wonder, what brave new world is this?

At the next table, another man is dining alone, waiting for his flight. He, too, has a laptop computer in a case at his feet. But he wears a tiny earphone, and a tiny microphone on a wire around his neck. All through dinner, as he digs into his fried clams and sips his Chablis, he animatedly chuckles and gestures, conversing warmly. He is having dinner with his wife, perhaps, or a friend, who is, physically, not there.

Since writing this article, Richard Wolkomir has had the odd feeling that his kitchen wants to tell him something. Illustrator Wally Neibart is based in Elkins Park, Pennsylvania.

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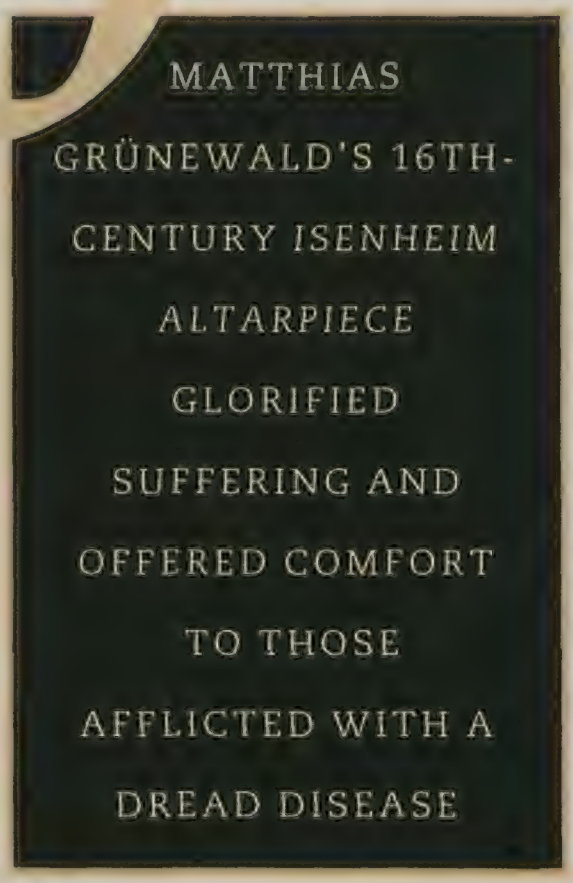
A Masterpiece of Saint Ant

BY STANLEY MEISLER

THE *ISENHEIM ALTARPIECE*, PAINTED BY MATTHIAS GRÜNEwald almost 500 years ago, is regarded by scholars and critics as a sublime artistic creation, an icon of Western civilization like Leonardo da Vinci's *Mona Lisa* or Michelangelo's Sistine Chapel. Yet, in all of last year, barely 250,000 people came to the Unterlinden Museum in the French Alsatian town of Colmar to look at this masterpiece of Northern Renaissance art. That is a paltry number compared with the millions who crowd into the museums of Paris and Rome and New York every year to render homage to similar stirring creations. "Of the handful of the greatest works of Western art," *New York Times* art critic Michael Kimmelman wrote after making a pilgrimage to the altarpiece in 1998, "it's the one that may have been seen by the fewest people, certainly by the fewest Americans."



Colmar, a pleasant town of 80,000 with quiet walkways and flowered canals, is far from the main tourist routes and sites of Europe. The town does boast the historic home of Frédéric-Auguste Bartholdi, the sculptor of the Statue of Liberty, as well as a nearby restaurant that was awarded the Michelin Guide's highest ranking of three stars. Nonetheless, relatively few visitors take the trouble to visit this small city near the German border.

Yet, though the altarpiece has never been viewed by masses of people, it has demonstrated a profound influence on the few. When he first came upon the work in the 1920s, Elias Canetti, the Bulgarian-born author and future Nobel laureate, did not want to leave at closing time. "I wished for invisibility," he said in his memoirs, "so that I might spend the night there." He completed his celebrated novel *Auto-da-Fé* in Vienna in a room bedecked with reproductions of the masterpiece. The German composer Paul Hindemith based his 1930s opera *Mathis der Maler* (Mathis the Painter) on Grünewald and the altar. In 1932, the altarpiece inspired Pablo Picasso to complete a series of ink drawings of the Crucifixion. Although most of his figures, in the Picasso manner of that era, resembled sculpted bone, a discerning viewer could make out distinctive allusions to Grünewald.

Grünewald painted the panels of the altarpiece from 1512 to 1516 in a chapel of a hospital and monastery run by Antonite monks in the town of Isenheim, about 15 miles south of Colmar. The monks took their name from Saint Anthony, whom they venerated as a healer and sufferer who pioneered the idea of monasticism in Christianity. The Antonite order operated the hospital in Isenheim largely for those afflicted by a disease known then as "Saint Anthony's fire."

That disease (now rare and called "ergotism") struck down many in periodic epidemics during the Middle Ages. Saint Anthony's fire set off painful skin eruptions

Born & Hony's

Grünewald's altarpiece is renowned for its vivid, glowing portrayals of uplifting scenes, such as that of the Madonna and Child, as well as more tortured images.

that blackened and turned gangrenous, often requiring amputations. The eruptions were accompanied by nervous spasms and convulsions. Many victims died.

Saint Anthony's fire came from the poison of a fungus that clung to rye and was inadvertently pounded into the flour used to make rye bread. The cause, however, was not known in Grünewald's time. The monks treated the sick with a balm made from herbs and other plants and with prayers to Saint Anthony, who was believed to possess miraculous curing powers. The monks also tried to bolster the faith of the sick by reminding them that Christ—and Saint Anthony as well—had suffered even greater torments. Grünewald's altarpiece played an important mystical and psychological role in the Isenheim treatment program.

Grünewald, a contemporary of fellow German painter Albrecht Dürer, was an artist and engineer whose previous work, while distinguished, never reached the breathtaking heights of the altarpiece in Isenheim. At the direction of the Antonite monks, he took an existing altarpiece of wood carvings and transformed it into a stunning, many-layered polyptych of two large paintings and seven smaller ones on surrounding wooden panels.

The resulting work was designed to show three different sets of scenes, depending on how many "wings," or hinged panels, were swung open. A terrifying *Crucifixion* dominated the altarpiece when all the wings remained closed. Opening the first pair of wings revealed an *Annunciation*, a glorious *Nativity* and a mystical *Resurrection*. When the second pair of wings was swung back, the piece, now completely open, would delve into the troubled life of Saint Anthony. The different phases could be shown in the chapel at different times of the year: the *Nativity* at Christmas, for example, and the *Crucifixion* on Good Friday. But no matter what scene was exposed, the altarpiece would bristle with meaning for sufferers of the dreaded Saint Anthony's fire.

The closed stage endowed the altarpiece with its greatness. J. K. Huysmans, the 19th-century French novelist, wrote that when one came upon the "horrific nightmare" and "pitiful horror" of the *Crucifixion*, it was "as if a typhoon of art had been let loose," and was sweeping you away. Christ's tense hands and feet writhe under the pain of the nails driven through them. His emaciated body is strewn with sores. The Isenheim patients could have no doubt about his suffering.

The middle stage, with one set of wings open, features a Nativity scene in which Mary and the Christ Child are serenaded by a strange choir of viol-playing angels. A tub,

Saint Anthony—whose name was taken by the Antonite monks and given to the disease that afflicted their patients—figures almost as prominently as Christ in the artwork.

a chamber pot and a crib at Mary's feet are stark, realistic notes in an otherwise supernatural scene.

The most hopeful and unusual section of the middle stage is the panel that portrays the Resurrection. Aglow and surrounded by light, Christ bursts out of his tomb, a slight smile on his red lips, his skin as white as alabaster. Nothing remains of his suffering save for a neat red slash on each palm and foot and a slim scar on his side. In this work, Huysmans maintained, "Grünewald shows himself to be the boldest painter who has ever lived."

The final stage, with all wings open, is not all Grünewald. The altarpiece was designed to hold an existing display of gilded wooden sculptures created by Niklaus Hagenauer some 25 years earlier. The sculptures include large figures of Saint Anthony and other saints associated with healing. They are flanked by two wings painted by Grünewald that dramatize episodes in the life of Saint Anthony.

On the left, Anthony meets Saint Paul, a fellow hermit, in an eerie forest. The scene is tranquil, and special plants sprout near the feet of the saints—plants used for the balm administered by the Antonite monks. But tranquillity vanishes in the other wing as Saint Anthony battles the fury of ferocious demons trying to torment him into abandoning his faith.

For the past two centuries, no one has seen the altarpiece the way the monks and patients did when it loomed over the chapel of the hospital in Isenheim. The work was dismantled long ago. A visitor today can see all of the altarpiece's paintings, but they no longer open onto each other. Wooden models on the wall demonstrate how the polyptych once worked.

Scholars and tourists sometimes complain and demand that the museum put the altarpiece back together. "But how do you do this?" asks Catherine Leroy, a curator in charge of the altarpiece and other medieval art in the Unterlinden Museum. "Which part do you show and when? How do you work out a system to make the altarpiece open and close automatically?" The museum has managed to keep Grünewald's paintings in good condition partly because the wooden sections are separated and do not smack against each other. Says Leroy, "To show it any differently than we show it now would be indefensible."

Much like the mystery of William Shakespeare, the identity of Matthias Grünewald remains shrouded in confusion and conjecture. The name Grünewald itself, in fact, is not correct. A German painter and historian, Joachim von Sandrart, mistakenly assigned it to the artist in a book published in 1675. Most scholars now believe that Grünewald's real name was either Mathis Gothardt or Mathis Gothardt Neithardt, but they continue the convention of using the wrong name. The details of Grünewald's life also remain largely a mystery. What is known is that he was born around 1480 in the German Bavarian town of Würzburg. He became a painter, an engineer, a manufacturer of paints and soap, and the designer of, among other projects, the reconstruction of the Aschaffenburg Palace in Bavaria. His reputation as a painter must have been considerable, for the Antonite order in Isenheim was wealthy and sought renowned artists to decorate its chapel. Today, barely a dozen of his major works exist, residing mainly in German museums and churches. There is only one Grünewald painting in the United States—a small Crucifixion scene in the National Gallery of Art in Washington, D.C. And, of course, there is the altarpiece at Colmar.

The *Isenheim Altarpiece* flirted with danger more than once in the bizarre history that followed its creation. For several centuries, admirers were sure that Dürer, the acknowledged Northern European master, must have painted it. Near the end of the 16th century, Rudolf II, the Holy Roman Emper-

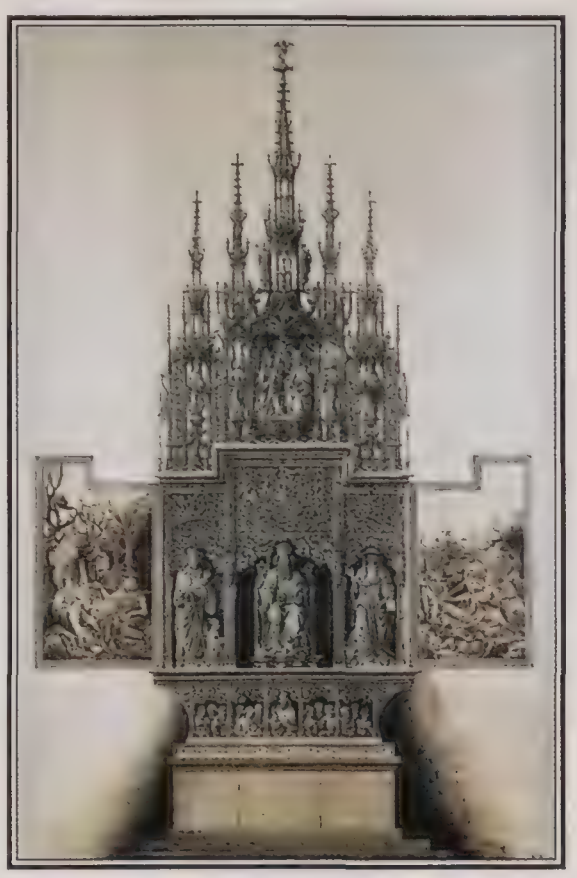
ALL ALTAR PHOTOGRAPHS GIRAUDON, PARIS

or, tried to buy the polyptych from the Antonite monks for his collection. But the monks refused to sell.

Attention to the altarpiece dwindled over the years as the hospital became less important. The cause of Saint Anthony's fire was discovered, and millers began to root out the poisonous fungus from the rye. In 1777, the Antonite monks lost their identity when the Knights of Malta took over the order. The French Revolution soon unleashed a bitter onslaught against the Catholic Church and its property. Mobs stormed the Isenheim complex in 1793 and looted the chapel. The sculpted base and crown of the altarpiece vanished. The panels were dismantled. Two government officials, however, managed to save all the paintings and most of the sculptures and store them in the library of the former Jesuit school in Colmar. Ultimately, the Isenheim chapel burned down.

In the middle of the 19th century, a society of art connoisseurs persuaded the city of Colmar to give up plans to demolish the former Dominican convent known as the Unterlinden. Instead, the society was allowed to transform it into a museum to house the *Isenheim Altarpiece* and other religious art rescued from the revolution.

The altarpiece's move to Colmar had already awakened interest in Grünewald and his work. A policeman who liked to delve into art history in his spare time proved that the paintings were the work of Grünewald and not Dürer. Later scholars shed light on Grünewald's identity. But it was not until the novelist Huysmans published his passionate praise at the turn of the century that word spread throughout Europe of the altarpiece's value and uniqueness.



A 1905 drawing shows how the altar may have originally looked, with wings open.

When World War I erupted in 1914, the paintings were in German hands. France had lost Alsace, Colmar, the Unterlinden Museum and the *Isenheim Altarpiece* in the Franco-Prussian War more than four decades earlier. Out of fear that the altarpiece would be damaged in fighting along the French border, the German Expressionist painter Max Beckmann urged his government to move it for safekeeping. The government agreed and put the paintings in the Alte Pinakothek in Munich. Upon visiting the museum, the novelist Thomas Mann described the paintings as "among the strongest that ever came before my eyes." The Prague-born poet Rainer Maria Rilke, urging a friend to visit him in Munich, held out a chance to see Grünewald's altarpiece as an incentive.

The paintings underwent their last major restoration in Munich, one that the French suspected was too heavy-handed. Leroy, the Unterlinden curator, says, "We still know very little about what they did." Alsace reverted to France after the war, and the Germans reluctantly returned the altarpiece to Colmar after long negotiations.

On the eve of World War II, the French, fearing that Colmar was too close to the German border, moved the altarpiece to a castle in southwestern France, near Limoges. After occupying France, the Germans transported the work closer to Germany, putting it in a cave in the Vosges Mountains in Alsace. When the war ended, Allied soldiers and German prisoners returned the piece to the museum in Colmar, where it has remained ever since.

Scholarly interest in the altarpiece, which peaked between the wars, continues today. The Library of Congress catalogue cites more than 20 new books on Grünewald, in English, French and German, since 1975. But, while interest in the *Isenheim Altarpiece* has not slackened in academic circles, there has been a decline in the public's interest. More than 350,000 visitors came to the Unterlinden Museum in 1987. Last year the number was down to 250,000. Catherine Leroy attributes the decrease largely to the end of the Cold War. "Many Germans who used to vacation in France are now going eastwards to countries that they could not visit before," she says.

For today's pilgrim to Grünewald's masterpiece, however, there is a blessing in the relative lack of other visitors. You're often free to sit for hours, savoring the power and beauty of the paintings. No one blocks your view. You do not have to elbow anyone to see portions up close. There is so little noise you can hear the intake of breath. You cannot have such blissful privacy amid the massive crowds in front of the *Mona Lisa* at the Louvre or within the Sistine Chapel in Rome. For that alone, it's worth the trip.

Author Stanley Meisler first came upon the Grünewald altarpiece in the 1980s as a Paris correspondent for the Los Angeles Times.

MUSÉE D'UNTERLINDEN

To see all the panels of the altarpiece, fold out. ➡

The *Isenheim Altarpiece*, with wings closed, presented the agonized *Crucifixion*, center, the *Entombment*, bottom, and depictions of two saints who, like Christ and the patients at the Antonite hospital, also knew suffering: *Saint Sebastian*, left, and *Saint Anthony*, right.

In the *Crucifixion*, the Virgin Mary faints into the arms of the apostle John, as Mary Magdalene kneels in desperate prayer. John the Baptist, returned from the dead, points to Christ withering on the cross, reminding patients that pain can bring one closer to God.

The first set of panels swung open to reveal an array of heavenly images. On either end were panels portraying scenes before Christ's birth and after his death. At left, in the *Annunciation*, the angel surprises Mary as she reads the prophetic words of Isaiah. At right, in the *Resurrection*, Christ ascends in a radiant halo.

At the center, two panels—distinct in mood and subject—were wed in one otherworldly scene, the *Incarnation*. In the *Nativity*, center right, Mary cradles Jesus below a golden, jubilant heaven. In the *Concert of Angels*, center left, modern scholars have noted an undertone of evil in the gathering of unearthly performers.

With all wings open and the *Entombment* panel removed from below, the gilded carvings of a preexisting altarpiece were revealed. The sculptures in that work include a portrayal of Christ and the Twelve Apostles, below, and figures of Saint Augustine, left, Saint Jerome, right—and Saint Anthony, center.

On either side were panels dramatizing moments from Saint Anthony's life. On the left is the *Visit of Saint Anthony to Saint Paul the Hermit*. In the surreal *Temptation of Saint Anthony*, right, patients may have identified as much with the bloated, pockmarked creature in the foreground as with the beleaguered saint.

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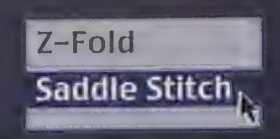

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A dangerous bark scorpion perches on the finger of Jude McNally at the Arizona Poison and Drug Information Center.

SOMETHING JUST BIT YOU?

PHOTOGRAPHS BY WILL VAN OVERBEEK

BY STEVE KEMPER

HEARD THE ONE about the guy who was bitten on the lip when he tried to kiss a rattlesnake? "Oh yeah, we see a few of those every year," says Jude McNally, the unflappable managing director of the Arizona Poison and Drug Information Center (APDIC) in Tucson. "The guy might *say* that the snake was just sitting on his chest and he sneezed and startled it," continues McNally, "but *we* know that he was kissing the snake."

WAS IT A SCORPION? A SPIDER? A SNAKE? THE TOXIN EXPERTS AT APDIC CAN TELL YOU WHAT TO DO

Pictures of rattlesnakes cover McNally's office walls. A sign on his door says, "The More People I Meet, the More I Like Rattlesnakes." Plastic scorpions and black widows squat on top of his computer. He sits next to cages holding a giant desert hairy scorpion and a huge tarantula. While talking on the phone about some toxicological dilemma, he sometimes lets the tarantula stroll around on his forearm.

When it comes to venomous bites and stings, McNally has seen most things and knows about the rest. Arizonans get into more trouble with poisonous creatures than do the residents of any other state; health authorities report about 15,000 cases and phone calls each year. APDIC, which is part of the University of Arizona's College of Pharmacy, handles about half of them.

Geography is a big part of the reason. Many of North America's most dangerous animals live in the deserts and mountains around Tucson, including rattlesnakes (11 varieties), coral snakes, scorpions, brown spiders, black-widow spiders and gila monsters, not to mention toads that exude a hallucinogenic toxin.

The second reason for all those bites and stings is Tucson's booming population, now more than 700,000. As subdivisions sprawl farther and farther into the desert, they invade more and more ancient domains of poisonous creatures. To snakes, spiders and scorpions, residential developments must seem like oases. Black widows and brown spiders set up shop in garage corners, scorpions nestle in slippers, and rattlesnakes bask on patios. Result: bites and stings.

The third contributing cause might be called the Pecos Bill Syndrome. (The tale goes that when Pecos Bill tangled with a rattler, he granted the varmint the first three bites just to be fair, then whupped it and whirled it like a lariat at gila monsters.) The syndrome's principal ingredients are machismo and testosterone, often inflamed by alcohol. When a snake bites a woman

or child, 90 percent of the time the wound occurs on a foot or ankle. But among males over age fifteen, 90 percent of the bites occur on an upper extremity, usually a hand or arm. Snakes don't generally jump that high, which is why McNally describes most such bites as "illegitimate." "That means you saw the snake, knew it was dangerous and did something stupid anyway," he explains. "It's always the drunkest guy who gets bitten."

And then, finally, there's that peculiar frame of mind called "ophiophilism," which means love of snakes. Some people just can't resist fooling around with poisonous serpents. They feel compelled to pick them up or keep them in cages or kiss them. Sometimes they just want to do something nice for a reptile, like the old lady who was bitten while using a short stick to help a rattlesnake cross a busy road. Sometimes they become herpetologists.

Peter Holm, a graduate student at the University of Arizona, was doing a herpetological inventory of the Whetstone Mountains last summer when he attempted to measure the rattle segments of a snake placed headfirst inside a plastic tube. As he glanced at the tape measure, the rattler freed itself from the tube and buried its fangs in his middle finger.

Holm hiked four miles back to the car, drawing a new line on his arm every 20 minutes to mark the advance of the swelling. "I couldn't believe my arm could get that swollen," he says. "It was so big, I couldn't hold it up. And it felt like a freight train was running over it." By the time he got to the University Medical Center, which is next door to APDIC, he felt cold and clammy, and had begun to shake.

Holm received morphine and antivenin. Purple blisters formed around the bite. His lymph nodes ached. It was a week before he could make a loose fist; it would take six months for him to make a full recovery. When he went back into the field to catch snakes, it was with considerably heightened concentration. But he doesn't hold a grudge. "It wasn't the snake's fault," he says.

Jamie Pierson, who received 81 vials of antivenin and spent three days in the hospital after being bitten by a rattlesnake, plays with a pet boa constrictor outside his house.

Jamie Pierson takes the same benevolent view of the three-foot rattler that poisoned him recently. Pierson keeps a python and a boa constrictor as pets. He has caught and handled many nonpoisonous snakes—bulls, kings, racers—and often crosses paths with rattlers. One evening he was out looking for critters with several friends in a desert wash near his hometown of Oracle. He decided, for reasons he still can't explain, to pick up a diamondback. He pinned the snake to the ground with a pipe and picked it up. "As I started to put it down, I watched him move his head to the left just enough to hit my finger with one fang," recalls Pierson. "I was in awe." On the drive to a local hospital, the pain kept intensifying. It felt like a hammer blow. Pierson made his second mistake when he twisted a tourniquet around his finger. The pain redoubled. The back of

his head and ears burned. Physicians at the hospital took one look and had him rushed 40 miles by ambulance to the University Medical Center.

Pierson's arm had swollen all the way up to the shoulder. "His hand looked like an inflated surgeon's glove," says Dr. Leslie V. Boyer, the medical director at APDIC. She diagnosed Pierson's poisoning as "severe" and started pumping antivenin into him. Twenty vials is usually enough. Pierson needed 81. He spent three days in the hospital and remembers chuckling when Boyer told him, "You don't qualify as the typical male snakebite victim: you weren't drinking, you don't have any tattoos and you have all your teeth."

When I interview him a week after the bite, blisters still cover Pierson's finger, which is black from the blood beneath the skin. He is also afflicted by "serum sickness," an itchy rash from head to toe caused by the impurities in antivenin. It will be at least two months before he can return to work as a copper miner. And what did the experience teach him? "It didn't make me not want to pick up a rattler again," Pierson tells me.

In Arizona, scorpions are harder to avoid than rattlesnakes. In 1997, APDIC responded to about 170 rattlesnake bites and 2,672 scorpion stings. More than 50 species of scorpion creep around the state, including the fearsome-looking 5½-inch giant desert hairy.

Most of the frantic people who call the poison center about scorpion stings are advised to wash the wound with soap, ice it and take aspirin or acetaminophen. Similar at-home treatment works most of the time for the bites of tarantulas and black widows. Brown spider bites, which attack tissue and cause necrotic lesions, require a trip to the hospital.

The dangerous exception among scorpions is the inch-and-a-half-long bark species, which packs a venom that's potentially lethal, especially to children or people with cardiovascular or respiratory problems. In Mexico during the 1940s and '50s, more than 20,000 deaths were traced to the bark scorpion. Mexican children in remote areas still die from its sting. It killed 75 people in Arizona between 1929 and 1965, but none since then, experts say, thanks to better treatment and more medical facilities.

Bark scorpions like to hide in dark places—everything from desert ledges and pack-rat middens to sneakers and clothing on a bedroom floor. They're common in the suburbs of Tucson, so children are taught to wear shoes at all times, even indoors. But the critters are hard to avoid.

A DANGEROUS ARACHNID HIDES INSIDE A HAT

SIX-YEAR-OLD CASEY ELMORE WAS playing dress-up with his sister outside their Tucson home when he put on a hat that had been lying on the ground. A bark scorpion in the band stung him behind the ear. His mother, Donna, recognized the arachnid and knew its sting was dangerous.

She called APDIC and was told to get Casey to a hospital immediately. Within 15 minutes after the sting, his eyes were rolling. Ten minutes later, his arms and legs started twitching. At the hospital, he thrashed so violently that it took six people to hold him down for an injection of a muscle-relaxing sedative, which stopped the severe convulsions that can choke off breathing and cause death. Improved but still agitated, Casey was sent to the University Medical Center for intensive care treatment. He went home the next day, tired and sore but otherwise OK.

ANCIENT PRESCRIPTIONS FOR POISONOUS BITES

ACROSS THE COUNTRY, THE NUMBER of fatalities from poisonous bites and stings is heading down. Of the estimated 8,000 people bitten by rattlesnakes every year, only 8 to 15 die. The nation's 75 poison centers are one reason. They are funded at the state and local levels, often by hospitals, universities or health departments. APDIC began in 1980. Today its 12 poison specialists answer 200 to 250 calls every day. It's fascinating to eavesdrop for a few minutes.

"No, an ant bite can't sever the tendon between your toes."

"A kissing bug bit you under the arm three days ago and it still hurts? Take some benedryl . . . No, you won't go into anaphylactic shock."

"An ant bite or wasp sting can cause swelling on a dog's nose. As long as he's breathing all right, he's OK."

In ancient times, people had some weird ideas about how to handle poisonous bites. The Greek physician Nicander prescribed salt, rabbit curd, sheep dung or immersion in wine for a spider bite. For snakebite, he recommended wine with the viper's head in it. Aristotle, always direct, advised eating the snake. Pliny suggested pressing the snake's intestines to the wound.

Tucson-area fireman George Good shows how a metal grabber is used to capture rattlers that turn up in backyards. The trespassers are usually released in the desert.

Things did not improve very much through the ages. A paper McNally coauthored on pit-viper poisoning begins, "[The] history of snakebite treatment has been characterized by dread, misunderstanding and confusion," and then lists a few of the cures inflicted during the 1800s and early 1900s: strychnine, enemas, carbolic acid, cauterization and copious doses of alcohol. Many people who might have lived through venomous bites were killed by alcohol poisoning.

The myth that booze counteracts poison still had enough force in the 1950s and '60s to interest a prominent researcher in Arizona named Herbert L. Stahnke. He conducted extensive tests on rats, giving them an injection of venom followed by one of vodka, scotch, tequila or cherry brandy. He concluded the liquor did not help. Stahnke recommended tourniquets and cryotherapy, as well as antivenin. Tourniquets were supposed to slow

the dispersal of venom from the bite to the rest of the body. "Cryotherapy," a fancy medical term for immersion in ice water, was supposed to do the same thing, and also preserve tissue. Both techniques were eventually debunked—tourniquets because they cut off blood circulation and cryotherapy because it causes frostbite—but not before many people needlessly lost digits and limbs.

The latest quack cure is electric shock. Remember McNally's story about the guy, bitten on the lip, who said he just happened to have a viper coiled on his chest? His buddy convinced him that electricity neutralizes poison, connected his lip to a car battery with a jumper cable and started the car. The snakebite victim soon passed out, unbeknownst to the "therapist," who continued revving the engine behind the car's raised hood until the patient's face was half-fried.

What *should* you do if you are bitten by a rattler? People who call APDIC get simple advice: go to the nearest hospital immediately. Don't waste time with ice, drugs, newfangled suction devices, or with the old cut-and-suck method. Try to stay calm and warm, and, if possible, elevate the affected limb.

One afternoon a cleaning woman from Panama told McNally about a snakebite cure her brother swore by. She showed him a large seed from a tree back home. Simply shave some of the seed into half a cup of water, she told McNally, and drink it. She said she had used it herself many times to counteract scorpion bites.

McNally listened politely but skeptically. He knows there are no bark scorpions in Panama and that stings from other species are rarely fatal. As for the snakebitten brother, it's what McNally calls "the dead chicken on the arm idea." About 25 percent of all poisonous snakebites are "dry"—that is, the snake doesn't inject any of its venom. Another 25 percent involve minimal venom; 25 percent are severe but not life threatening; and 25 percent are potentially lethal and require antivenin. "So a guy in the first group puts a dead chicken on his arm and lives," says McNally, "and he tells the guy in the second group about it, who tells the guy in the third group. All of them would have lived anyway, but now the idea gets around that a dead chicken on the arm is a cure. And *that* is truly the history of snakebite first aid."

Venom still bewilders medicine. Each bite and sting represents an unknown load of poison. Some venoms contain as many as 130 ingredients, and researchers still don't understand how they interact to set off a cascade of physiological reactions. Venoms differ greatly—they may attack tissue, the blood, the heart, the neurological system or a combination of these. Arizona's Mojave rattler, for instance, comes in two venomous

versions, one that affects the neuromuscular system and another that destroys tissue and causes edema.

Nervous doctors from around the country call APDIC asking how much antivenin to give the victims in their emergency rooms. But for the reasons mentioned above, McNally's answer is usually: it depends. "Treatment is more an art than a science," he says. "Doctors don't like that."

"WE WILL RECOGNIZE SCORPION STINGS"

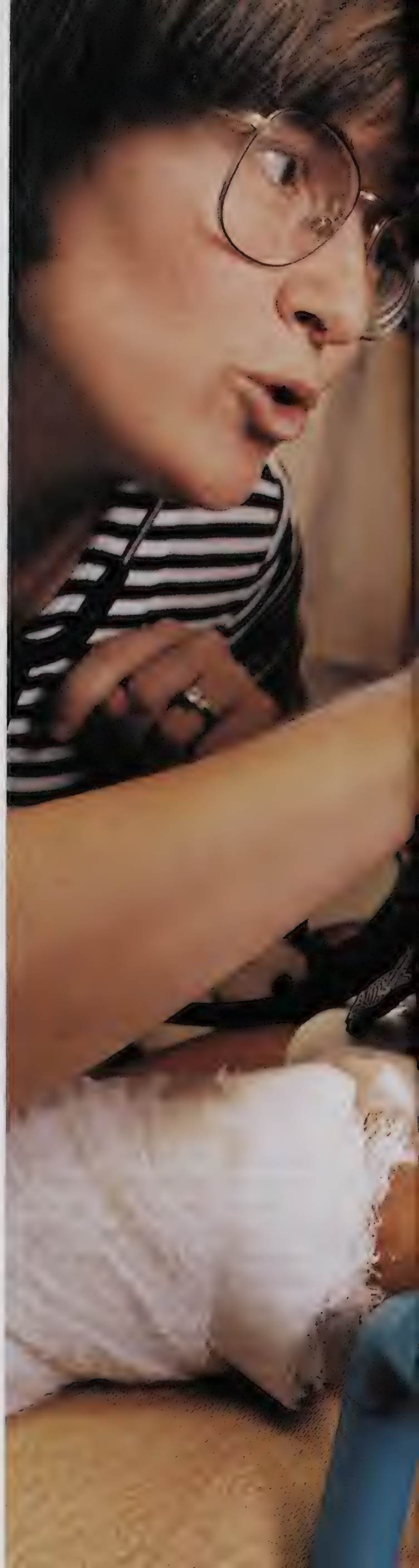
FEW DOCTORS RECEIVE TRAINING IN venomous bites and stings. Leslie Boyer, APDIC's medical director, knows firsthand the consequences of this. She grew up in the desert foothills outside Tucson, familiar with all the poisonous creatures there. After attending Harvard Medical School, she returned to the university hospital as a pediatric resident. One day Boyer was called in to give a spinal tap to a thrashing infant in intensive care. Afterward, when the child was rolled over, she noticed the involuntary movements that are classic symptoms of a scorpion sting. She was appalled that she and her colleagues had not considered it right away. "I became evangelical," she says. "I said, 'We *will* recognize scorpion stings.' Then I discovered the poison center, and I got hooked. I love this job. It is never, *ever* mundane. The bites are all different, and the patients and doctors who call are all different."

Medicine's most powerful snakebite weapon, antivenin, has hardly improved in 40 years. The serums are still made by repeatedly injecting venom into horses (or sometimes sheep) until they develop resistance. Then blood is drawn and processed into a serum. "So when you inject it," says McNally, "you're giving someone a whole lot of horse protein." Most people who take antivenin get a bad allergic reaction to those impurities. Six years ago, a man who received black-widow serum at a hospital in Phoenix died from anaphylactic shock. Some herpetologists use the serum only as a last resort, because the allergic reaction may worsen with repeated doses.

Antivenins are also expensive and inconvenient. Each vial costs the hospital $200. (The cost to the patient, who receives 17 vials on average, is twice that.) Moreover, before it can be injected, the serum must be reconstituted into solution, which means a vial must be rolled in someone's hands for 30 to 40 minutes, a tremendous waste of a staffer's time. For these reasons, Boyer and McNally avoid the stuff whenever possible.

The situation may improve soon. McNally is excited about one pharmaceutical company's new rattlesnake antivenin, which APDIC and the hospital have been testing for the federal Food and Drug Administration (FDA). It has fewer impurities and is safer and easier to use. However, it has cost the company, Therapeutic Antibodies, Inc., about $30 million just to reach the point where it can apply to the FDA for approval. This is why few research companies are interested in developing better antivenins. They see enormous financial risk and a relatively small market.

McNally has been trying to interest scientists at the University of Arizona in analyzing scorpion poison, the first step toward developing a better antivenin. In order to make it easy for researchers—and also because he enjoys it—McNally furnishes the venom himself by hunting scorpions in



APDIC medical director Leslie Boyer checks Marcos Leyva as his mother looks on. He had surgery to relieve pressure on a nerve near the site of a rattlesnake bite on his wrist.

the desert and milking them in the lab.

Scorpions come out after dark. One night I join McNally and a group of entomological enthusiasts on the edge of a dry wash in the desert. We walk into the wash carrying a black light, forceps wrapped with adhesive tape and a snake-grabber, in case of rattlers. Someone shines the black light on the bushes and ledges that line the wash. Scorpions luminesce like green Day-Glow images from an old '60s poster. They're surprisingly quick and skittery, but we soon collect about a dozen of them, including a giant desert hairy and a handful of barks and striped tails. The rest of us nab them with forceps, but McNally plucks them with two fingers. He has been stung only once by a scorpion. "It felt like an electric shock," he says. "The numbness and tingling lasted five days."

On the way back to our trucks, McNally and Jim Kloster, a poison specialist at APDIC, chat about a convict who was sent to the hospital recently after he started vomiting and his pulse dropped to 46. It turned out that he had eaten a Colorado water toad, whose skin oozes a bufotoxin with effects similar to LSD. The poison center gets calls every year about people who have used the toxin from the toads to get high, and from dog owners who are worried because their curious pets ate something in the yard and now seem to be hallucinating. The convict's motives for ingesting an entire toad aren't clear.

Before we head back to town, Richard Wagner, a doctor from the medical center, fetches his tarantula from a container in his truck and hands it to me. It covers my palm. Wagner senses my urge to fling the furry brute into the night. "Don't drop it," he cautions. "Their abdomens shatter like porcelain."

Its fangs look awesome, yet deliver a bite no worse than a wasp's sting. But the tarantula has another weapon.

Biologist Trevor Hare uses forceps to pick up a scorpion illuminated at night by a black light. Inset: Toxin from the brown recluse spider destroys tissue as it spreads.

When it's annoyed, it rubs its hind legs across its abdomen and flicks thousands of urticating hairs—hairs that sting—at its target. The attack resembles a shower of poison arrows, each hair carrying a venomous gland. APDIC sometimes gets calls from doctors puzzled by itchy rashes and sores on children's chests and groins. Diagnosis: the kids are keeping their pet tarantulas in their underwear drawers. Masking tape removes the hairs.

LEARNING TO MILK THE BARK SCORPION

AT THE LAB, MCNALLY SHOWS ME how to milk a bark scorpion. As he holds it, I touch two wires from an electric stimulator to the base of its tail. A tiny droplet, smaller than the bead of nectar from a honeysuckle blossom, appears at the tip. It's astonishing that this speck of venom causes violent convulsions and can kill a child. Using a pipette, McNally collects the poison, a tiny contribution toward a better antivenin.

A private fire department called Rural/Metro runs 14 stations that ring outer Tucson, where the new desert subdivisions have sprouted. The stations don't get all that many calls for fire, but they stay busy responding to requests to remove snakes—about 6,000 in 1997, most of them rattlers. "One station caught 23 just last week," George T. A. Good, an administrator with the company, says.

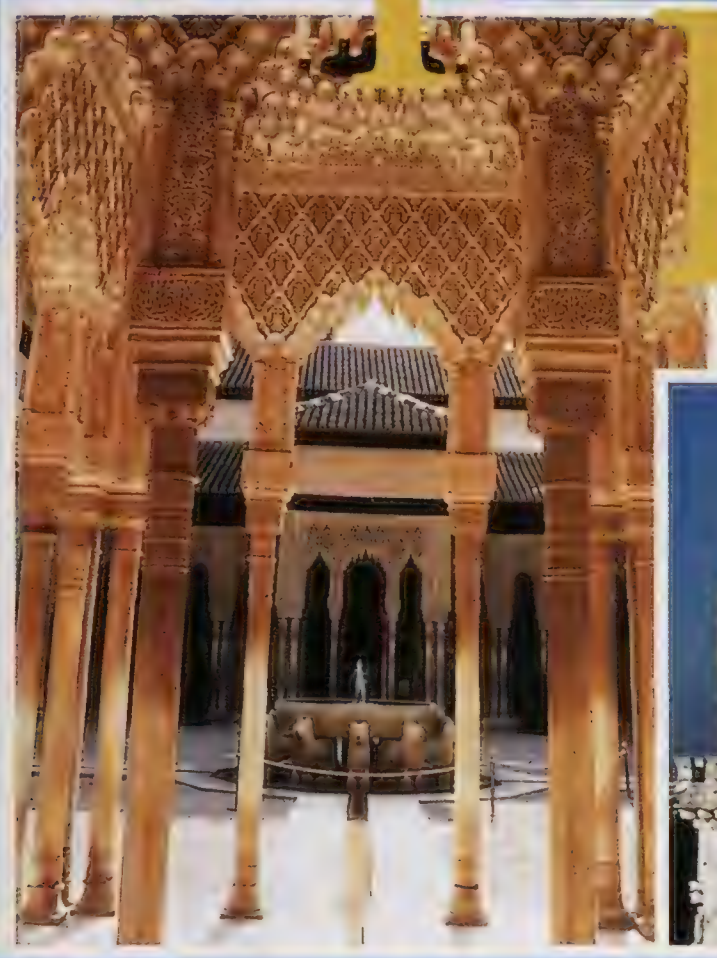
Where others might have seen a nuisance, McNally sensed an opportunity. He persuaded Good to let him educate the firefighters about snakes, so they can pass the knowledge on to homeowners. McNally also persuaded Good to hang on to the captured snakes until he and his brother-in-law, Trevor Hare, a field biologist, could get their hands on them for research. They wanted to implant some with radio transmitters to see how relocation affected them. Rural/Metro had been releasing the captured snakes in groups of 15 or 20 out in the desert. McNally and Hare found that this unbalanced an area biologically, and probably decreased public safety. Each snake needs 10 to 15 acres of habitat. Overcrowding causes the snakes to roam farther in search of food and spend more time on top of the ground. This not only exposes them to predators but endangers any humans who might be around.

The shortest distance is how McNally and Hare think the snakes should be relocated—preferably right over the back fence. The two have worked with Good to encourage Rural/Metro's firefighters to proselytize nervous homeowners about the blessings of resident snakes. McNally believes in education. His first aim is public safety, teaching people how to avoid venomous bites and stings: leave snakes alone, shake out clothing, don't go barefoot, watch where you put your feet and hands. He believes people can learn to live with poisonous creatures. He gives 60 to 70 talks each year to neighborhood groups, schools, paramedics, developers, professors, medical and pharmaceutical students: "To anyone who will listen, is my general principle." But he's fighting an aversion that may be programmed into our DNA.

I'm hanging around Rural/Metro's Station 73 late one afternoon with McNally and Hare, and soon the phone rings: someone has a snake on the patio. We arrive to find a nonpoisonous king snake about three feet long calmly swallowing a baby bird. As we wait for it to finish, McNally casually asks the fretting homeowner if she is having any trouble with pack rats. Yes, she says, they get under the truck's hood every night. McNally tells her that king snakes eat pack rats and other troublesome rodents, and she's lucky to have one around. Scott Ferguson, captain of Station 73, transfers the snake to a box and tells the woman that the best place for it is over the back fence, in the dry wash there, but he says he'll take it away if she prefers. "Take it away!" she blurts.

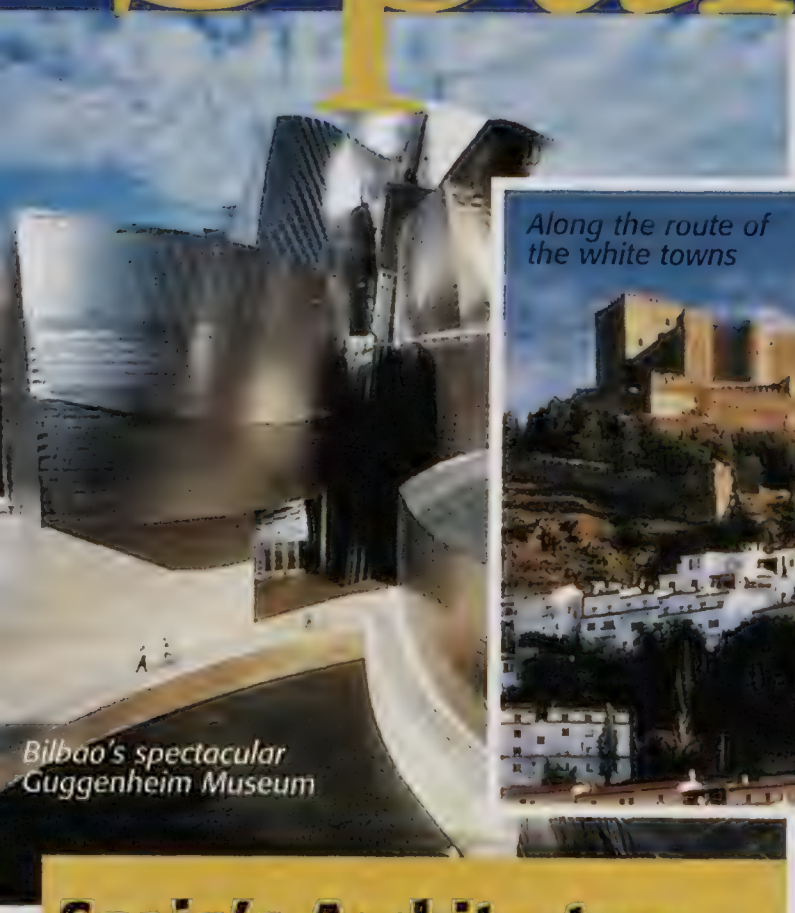
Steve Kemper has written recently about salt and anacondas. Photographer Will Van Overbeek lives in San Antonio, Texas.

Sojourn through Spain & Portugal



Two countries, one peninsula. Yet Spain and Portugal are distinctly different. Each has its own language. Spain is vast, rugged, a land of high drama that inspired painters, writers, and musicians. It is also a land of sophisticated cities, of world-class museums, yet of ancient unspoiled villages, too. Portugal, smaller by far, made its name as a seafarer. Prince Henry the Navigator, Vasco da Gama, Magalhães, Cabral—all were Portuguese and all changed the map of the world. The Maritime Museum and Monument to the Discoveries at Belém honor these great explorers. With their heritages of past cultural climaxes intact, Spain and Portugal now set their sights on a new age, and are entering the 21st century on fast-forward.

Spain A Country for Every Century...



Bilbao's spectacular Guggenheim Museum

Along the route of the white towns

Spain's Architecture A Visual Feast

Whether it's Don Quixote's windmills on La Mancha hilltops, the dazzling white Moorish villages of Andalusia or Romanesque churches of the Catalan Pyrenees, there is always something intriguing to see and explore in Spain. Here are a few of hundreds of monuments that compete for your attention:

- The magnificent Moorish trio of the south—Córdoba's Mezquita (mosque-cathedral), Seville's Giralda (12th-century minaret converted to campanile) and the glorious Alhambra overlooking Granada.
- Toledo, with legacies of a Golden Age such as El Tránsito synagogue, the Moorish Alcázar, and Gothic Cathedral.
- Roman reminders like Segovia's monumental aqueduct, the amphitheater in Tarragona, and, in Mérida, the Circus Maximus and theater, also the modern Museum of Roman Art (designed by leading Spanish architect Rafael Moneo).
- Gothic glories of Spain's great cathedrals at León, Toledo, Burgos and Seville.
- Unique *Modernist* buildings by Gaudí.
- The 16th-century El Corral de Comedias, Almagro's Elizabethan-era theater, where classic Spanish plays are performed.
- Medieval castles, monasteries, and palaces, converted to comfortable Paradors (hotels), wrapped in history.
- Modern 21st-century Spain, exemplified by the remarkable Guggenheim Museum Bilbao.

From Pre-History into the Millennium

The past is visible throughout Spain. And so is the future.

It is a mere 172 miles from the prehistoric Atlamira Caves, near the medieval Romanesque village of Santillana del Mar, to Frank Gehry's 21st-century Guggenheim Museum in Bilbao. This short distance, which spans the artistic millennia, abounds in examples of time leaps, from prehistoric to Greek and Roman, from Baroque to ultra modern.

Spain has preserved its millennia of treasures—its architecture, art, and cultural heritage. You still find Arabic arches as far north as Zaragoza, Greek and Roman remains at Empúries, Visigothic columns in Toledo.

Exploring Spain is always serendipitous, yielding exciting discoveries.

Art as a Way of Life in Spain

You'll find art in tiny Romanesque churches along the ancient Pilgrimage Trail of northern Spain, in monasteries like Las Huelgas Reales and Cartuja de Miraflores in Burgos, and in a myriad of museums, from the Ceramics Museum of Valencia to the Dalí Museum in Figueres and, of course, the Guggenheim in Bilbao.

In Madrid, top museums include the Prado, the Reina Sofía, the Thyssen-Bornemisza and the National Archaeological Museum (with its mysterious prehistoric *Dama de Elche* sculpture).

Barcelona's major treasure houses are the Museum of Catalan Art (with Romanesque chapels from Pyrenees villages), the Joan Miró Foundation, the Richard Meier-designed Contemporary Art Museum, Pedralbes Monastery, the Tàpies Foundation, and Picasso Museum.

Festive, colorful Andalusia

Note as well: the House and Museum of El Greco and his paintings in churches throughout Toledo; the Museum of Spanish Abstract Art in the cantilevered Castilian hill town of Cuenca; the Museum of Fine Arts in Seville.

Scenic Spain and Its Islands

Spain is noted for infinite scenic contrasts. There's Cantabria's emerald greenness, fjords and Atlantic coast; Los Picos de Europa, one of the last great wilderness tracts in Europe; Andalusia's 173,000-acre Doñana National Park, with spectacular wildlife.

On the Mediterranean, enjoy the Costa Brava, with fishing villages, remains of ancient Iberian, Greek and Roman outposts, and small luxury hotels; and the Costa del Sol, playground of sun-seekers, golfers, and tennis buffs.

Savor Rioja's wines and villages on the Pilgrimage Trail; and in Galicia, sample Spain's best seafood, and discover the medieval city and spiritual capital of Spain, Santiago de Compostela.

Andalusia, land of rolling hills, haciendas, sherry wineries, and bull-breeding ranches, glories in its Holy Week processions, colorful fairs and fiestas, while the Basque country boasts mystical mountains, Atlantic beaches, fabulous food and wine and the sophisticated seaside resort of San Sebastián (with its renowned international film and jazz festivals).

The seven volcanic Canary Islands, a nature lover's paradise, range from the lunar landscape of Lanzarote to lush, mountainous Tenerife to tiny, evergreen La Gomera.

The temperate Balearic islands—Mallorca, Menorca, and Ibiza, each with its own history, terrain and charm—lure hedonists of all nations.

Bravo Spain

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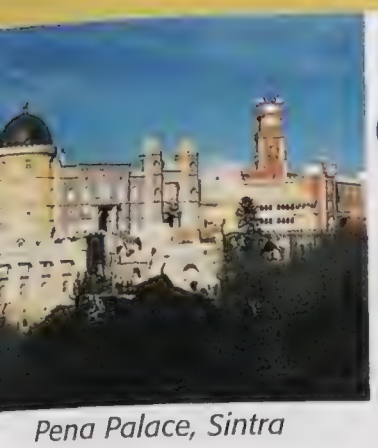

Pena Palace, Sintra

Castle Country

Is every jut of rock castle-crowned? Or topped by a walled town time forgot? In Portugal it seems so, especially along the Spanish frontier. There's Monsaraz, a town so white it might be carved of snow, wrapped around a 13th-century castle…cloud-high Marvão, the Herminius Minor of the Romans…Castelo de Vide with its architecturally intact Jewish ghetto…cliff-hanging Monsanto (once named Portugal's prettiest village)…Sortelha, a medieval granite town deep in the land of *bruxas* (witches). And that's not all. There's a valley of Paleolithic rock art at Foz Côa, there are Roman bridges everywhere, and so many menhirs archeologists believe the Standing Stone cultures of France and Britain may have originated in Portugal.

Gardener's Eden

The Portuguese have the greenest thumbs on earth plus a passion for topiary and parterres (intricately patterned plots). Some of its showiest formal gardens are in or near Lisbon: the 18th-century rococo pink palace at Queluz, the 15th-century Quinta da Bacalhoa with its impressive pavilions of tile, and the late 17th-century Fronteira Palace (Hans Christian Andersen praised its Italian Renaissance gardens). But there are dreamy woodland gardens, too—Estufa Fria in downtown Lisbon, Buçaco in Portugal's rumpled midriff. Quinta da Aveleda near Porto, and Terra Nostra Park on the Azores island of São Miguel, a firestorm of azaleas in spring. Then there's Madeira. As the 15th-century Venetian explorer Cadamosto wrote, "The whole island is a garden!"

Princely Pousadas

"Government inn" may have a grim "cot-and-candle" ring, but the 44 pousadas cached about the countryside provide every amenity the most demanding traveler could want. And top-of-the-line ones built inside centuries-old castles and convents offer unabashed luxury. Equally posh but less well known are the private manor houses where paying guests can breakfast (and sometimes dine) with Portugal's noble families.

Tile balcony in Lisbon

Fine Foods, Fine Wines

So proud is Portugal of its specialty foods that it's had scores of them declared "protected products" by the European Community. These include the buttery Queijo da Serra, its Queen of Cheeses, and fine-fleshed, air-cured *presuntos* (hams) of Chaves. Portugal's wines are a match for those of France—not Ports and Madeira, which are unique—but the lesser known table reds and whites from Douro, Dão, Estremadura and Alentejo. Many wineries treat visitors to tours and tastes, some even let them join the rollicking autumn *vindima* (grape harvest).

Bom Jesus shrine, Braga

21st-Century Portugal

Nothing symbolizes Portugal's commitment to tomorrow more than the new 11-mile bridge hurdling the Tagus just above Lisbon, trimming driving times to Spain, the Alentejo and Algarve. Vasco da Gama, the Portuguese named this bridge to honor their 15th/16th-century navigator, who found the water route to the spices of the East and made this little kingdom rich beyond belief. Has Portugal's time come again? It would seem so. Already this great soaring span has a nickname: "Highway to the Future."

Shopper's Paradise

Popular "must-haves": the terra-cotta casseroles of Barcelos, Redondo and São Pedro de Corval, the fanciful cabbage-leaf plates of Caldas da Rainha, the intricately painted pottery of Conímbriga and the delicate porcelains of Vista Alegre. Country markets at Barcelos and Estremoz sell earthenware by the acre as do the potters who make it—visitors welcome! Lisbon and Porto shops stock finer tableware and that includes Atlantis crystal. In addition, there are factory outlets at each source.

Also high on every shopper's list: the gossamer embroideries of Madeira, intricate cross-stitch rugs of Arraiolos and not least, decorative tiles. Several Lisbon shops sell, pack and ship. For the trendy, there's the cutting-edge couture of Ana Salazar and José António Tenente, both with Lisbon boutiques.

Portugal

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DURIANS

Smell Awful—but the Taste, Say the Brave, is Heavenly

BY HENRY GENTHE

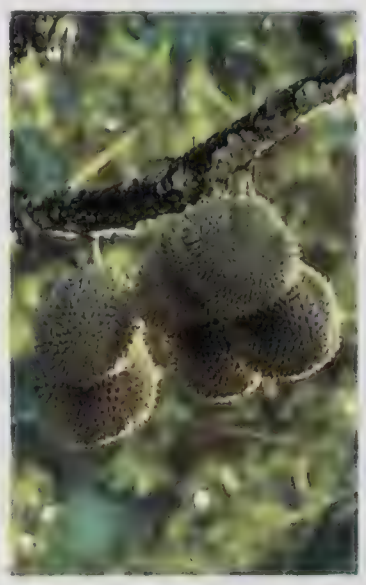
"OF ALL FRUITS, AT FIRST THE MOST INTOLERABLE, BUT SAID BY THOSE WHO HAVE SMOTHERED their prejudices, to be of all fruits, at last, the most indispensable. When it is brought to you . . . you cannot sleep. Chloride of lime and disinfectants seem to be its necessary remedy. To eat it, seems to be the sacrifice of self-respect; but endure it for a while, with closed nostrils, taste it once or twice, and you will cry for durians thenceforth, even—I blush to write it—even before the glorious mangosteen."

Driven by this odd description, from the 19th-century American journalist Bayard Taylor, I boarded a cross-country taxi in Kuala Lumpur, Malaysia, and headed north to a durian plantation on the island of Penang in the Andaman Sea.

As we approached the port of departure for Penang, an island state off the west coast of Malaysia, fruit stands lined the highway. Chartreuse- and rose-colored rambutans and deep-purple mangosteens, woven together with braided strips of bamboo, hung from palm-thatched roofs.

The unmistakable stench of ripe durians, piled like cannonballs in front of the roadside huts, permeated the air. How, I wondered, could anything that smelled so foul have elicited the rave reviews I had read?

More than a century ago the French naturalist Henri Mouhot wrote, "To enjoy it . . . one must have time to overcome the disgust at first inspired by its smell. On first tasting it I thought it like the flesh of some animal in a state of putrefaction. . . . " Other descriptions are even more blunt: "an abominable stench," "a revolting public lavatory," "reminiscent of rotting vegetables and bad drains." My cabdriver added this well-known durian saying: "They have the taste from heaven and the smell from hell."



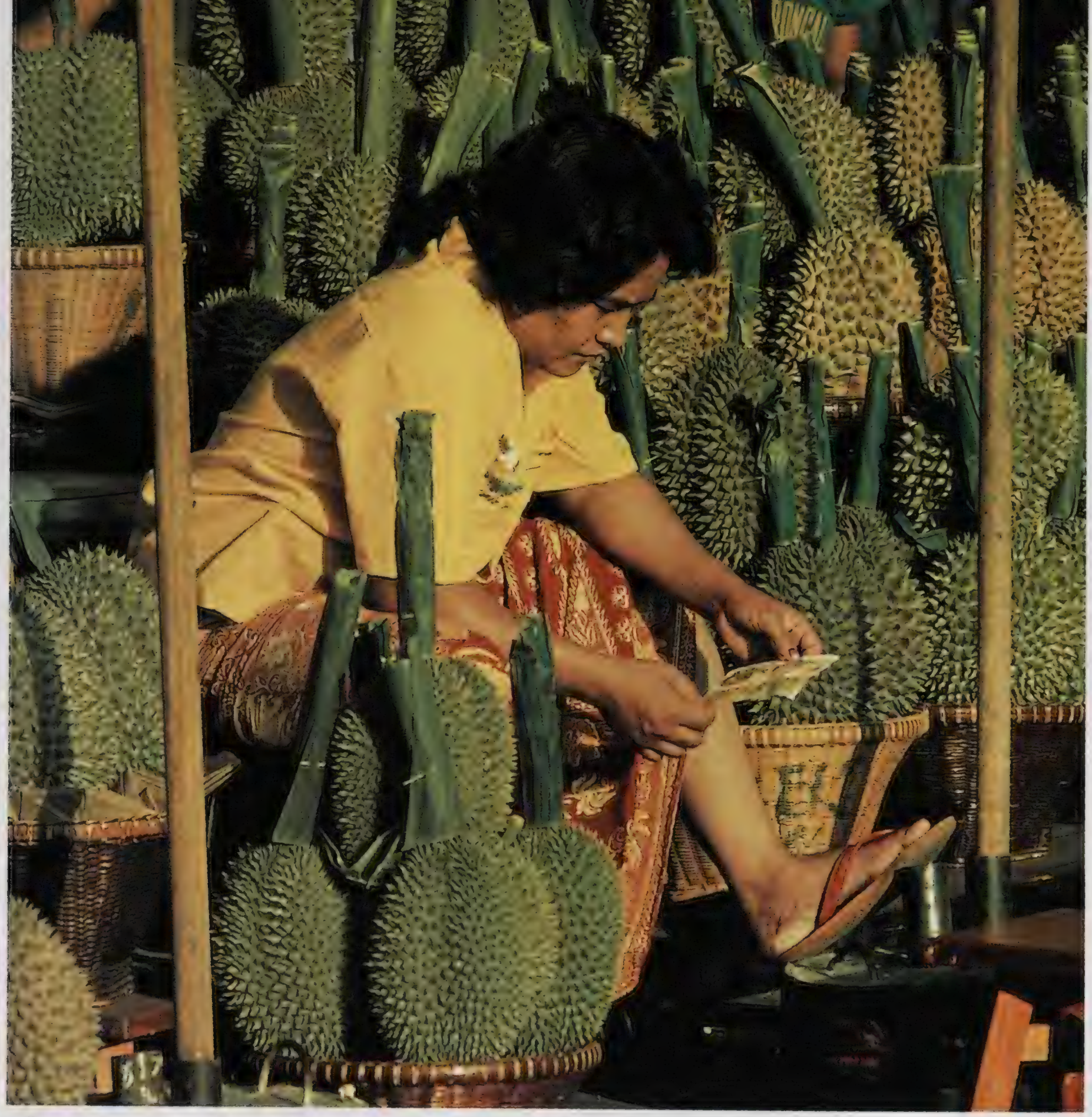
It is nearly impossible to tell from appearance alone when durians (above) are ready to eat. In a Borneo forest (left), an orangutan thinks he has a ripe one.

Even the durian's scientific name, *Durio zibethinus*, loosely translates as a "thorny fruit smelling of the civet cat," a mammal well-known for the foul-smelling secretions of its scent glands. I'd heard rumors that durians might be a sexual attractant in humans. Though aphrodisiacs have never been scientifically accepted, they do play an important social and psychological role in Southeast Asia. "Durians make you hot!" my cabbie laughed, adding to his unending litany of durian virtues. "Durian season is when all Malaysian women get pregnant. We say that when the durians come down, sarongs are soon to follow. I love to eat durians, but being a bachelor, I should eat mangosteens or rambutans next to cool off."

A green skin of stout spines covers the football-size durian. Inside, a smooth, white custard, the aril, surrounds the seeds. The explorers who brought word of the durian to the West found the flavor and texture of the aril (which is usually eaten raw) even more difficult to describe than the durian's smell. Biologist Alfred Russel Wallace wrote of a custard "flavoured with almonds . . . onion sauce, brown sherry, and other incongruities."

Chang Teik Seng, a Malaysian farmer, has been growing "champion durians" and now shares his love of the fruit with millions via the Internet. His Bao Sheng Durian Farm recently became the first in Malaysia to promote durians along the information highway. "Except in Malaysia and several Asian countries," Chang says, "the durian is almost unknown to foreigners." An even more expansive site, Durian OnLine (DoL), includes horticultural links, recipes, historical anecdotes, durian jokes and cartoons, and the Durian News Gallery.

In Singapore, John Hoe's Four Seasons, possibly the world's only all-durian establishment, is patronized, Hoe says, not only by adventurous tourists out for a taste of the exotic but also by businessmen and government officials. In addition, Hoe claims to ship tons of durians to customers around the world. One of his customers, he says, spends about $8,000 a year to feed his durian habit. On



Spiky fruits (the stems are left on as handles) surround a vendor in Bangkok.

the Four Seasons menu are such durian delights as pudding, puffs, pancakes and tubes of durian paste to take away. Even with a clientele of aficionados accustomed to the pungent "fragrance" of fresh durians, however, Hoe had to install a special ventilation system to prevent the odor from recirculating.

Fresh durians have an extremely short shelf life and are rarely exported much farther than Hong Kong or Singapore. Frozen durians on the other hand, though less odoriferous, but with a longer shelf life, are shipped to Western countries where smell is not an important criterion and new consumers would likely be turned away by the odor of the fresh fruit anyway.

The majority of fresh durians remain in Asia, and to taste one, you'll likely need to go there. In 1997, there were 35,000 tons of the fresh fruit shipped from Malaysia to Singapore, where the people would no more eat a frozen durian than they would drink tea brewed from a bag. So far, durian supply is keeping up with demand.

The increased durian popularity and prosperity have a downside for ordinary folks from Malaysia and Thailand, who eagerly anticipate the durian harvest and an abundance of affordable fruit each year. Some fruit sellers in Singapore are afraid that as populous areas like Hong Kong import more and more durians, the fruit's popularity will spread into China. The demands of one billion new durian lovers could quickly outstrip supplies and drive prices beyond the reach of all but the wealthy.

JOHN EVERINGHAM/ARTASIA; P. 96 MARK TUSCHMAN; P. 96 NEIL P. LUCAS/BBC NATURAL HISTORY UNIT; P. 97 SUKSAN SAMRANRIT/ARTASIA

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Sticky rice with a durian segment is a popular dessert in Thailand. Devotees top the dish with sweetened coconut milk, plain or—for diehards—with extra durian pieces.

In Singapore the government has tried in vain to discourage the consumption of durians in public, believing that the stench goes beyond the boundaries of good taste. "No Durians" signs, with the universal red slash through a durian, are prominently displayed on taxi stands, buses and ferries, in the subway and on airlines, where the fruits may be confiscated. But the people continue to consume vast quantities of durians nonetheless.

For the timid, the intense experience of eating a raw durian can be tempered somewhat by first trying durian in one of the delicious Indonesian soups, sauces or relishes in which it is used like a vegetable. Those lucky enough to purchase the rare fresh durian in an Asian-American market will find recipes on the DoL Website. For a hint of the taste, you might try Durian Dodol, candy with the consistency of leather that occasionally turns up in specialty markets. But you'll need to make a trip to the East to experience the flavor and unexpurgated smell of a durian fresh from the tree.

A rapid chemical change, triggered when the fruit drops from the tree, brings out the characteristic odor, an important criterion in selecting a choice fruit from the market. The ritualized purchase is slow, deliberate and taken seriously. Durians are not cheap. During the peak season, one durian can cost the equivalent of five American dollars and up. Off-season prices escalate dramatically. Subtle distinctions in smell, undetectable by a beginner, may be all that marks the difference between a fruit worth $10 and one that is tossed out with the garbage. Durians must be collected from the forest, transported to market, bought and eaten within several days, or the taste and smell become too overpowering for even the most confirmed durian eater.

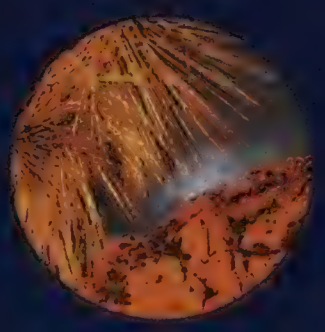
One afternoon in Singapore I watched a devotee barter with a vendor. He selected a fruit, picked it up gingerly (the spines are extremely sharp and the fruit heavy) and squatted on his haunches. Shaking it first, listening closely for the telltale rattle of loose seeds that betrays a fruit that has more seeds than flesh, he seemed satisfied that this durian had passed the first test of quality. Then began the slow rolling of the fruit over and over in both hands. Holding the durian close to his nose he inhaled deeply, totally absorbed in pungent odors that I could smell at a distance of several yards! He rejected the first choice. True connoisseurs will also refuse a fruit with a garlicky odor that has become too pronounced; or one with no smell at all, indicating a fruit harvested too early.

Durian OnLine offers detailed advice in choosing durians: "If you detect a faint aroma of bittersweet butterscotch and almonds with a bouquet of wild honey and a hint of smoked oak, then you have hit the jackpot and found yourself a durian with a thick, creamy, treacle-like, bittersweet flesh for you to savor and enjoy. And finally, as for the proper and correct way to open durians, bring them to me."

The Singapore buyer seemed satisfied that the second fruit had passed the sniff test. After the customer's subtle nod of approval, the vendor laid open the thorny skin with a large knife, revealing chestnutlike seeds buried in a custardy pulp—a ready-made gourmet dessert nestled in its own dish. After a taste, the customer smiled just slightly and continued the ritual, finally accepting several durians at their peak of ripeness and pungency. Barely a word was spoken. I felt like a spectator at a hushed Sotheby's auction, witnessing the sale of a priceless Ming vase. As I watched the client peel off several large bills in payment, I realized that this was not far from the truth.

Because durian trees can take up to 15 years before bearing fruit—which

SUKSAN SAMRANRIT/ARTASIA



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may not have the right combination of taste and smell—some of the durian crop in Southeast Asia is still harvested in the wild from well-known trees. To save the region from a possible durian shortage, researchers are trying to develop improved cultivars and better storage methods. Wedding the combination of smell and taste with long shelf life and increased productivity has so far proved tricky, however. Although there are more than 300 durian varieties, relatively few are cultivated, and some truly prime fruits are still harvested wild.

When a superior durian tree *is* discovered in the forest, it becomes a well-guarded property of nearby villages. Local people come from miles around to gather the fruits during the season. After savoring the custard, they throw the seeds into the bush, where they grow untended. Over the past several thousand years, this haphazard cultivation has spread durians across most of Southeast Asia from Malaysia and Sumatra, through to New Guinea. To the north they have been successfully cultivated as far as Thailand, Burma and the Philippines, to the west as far as Sri Lanka and India. Today, seeds from high-quality wild trees are sold to plantations.

Under ideal conditions such as those found in the warm, moist jungles of Penang, durians mature, flower and bear fruit in as little as eight years. The flowers, subtly toned in pinks and yellows, open in the evening. Their potent, milky-sweet odor quickly attracts fruit bats. Gliding silently through the forest canopy, they alight on clusters of flowers and thrust their heads into the open mouths of the bell-shaped blossoms. Pollen adheres to their fur and fertilizes neighboring flowers as the bats spend the night gorging on the rich durian nectar. Pollination must take place quickly, as the flowers shed their petals within a few hours of blooming.

A sign in a Singapore subway station attests to the strength of the durian aroma.

Three to four months later, jungle nights are punctuated with the heavy thuds of ripe durians plummeting a hundred feet or more to the forest floor. People from nearby hamlets come to do battle with elephants, monkeys, pigs and deer for the harvest. For several weeks the animals gorge and the people celebrate. Fruits are hauled to market, the money rolls in, and a feeling of prosperity and well-being pervades the countryside.

In addition to food for the body, durians provide food for thought with a contribution of parables and riddles to the rich and profuse folklore of Southeast Asia. One goes: "There is a porcupine sleeping on the branches of a tree. Its smell is extraordinary." Another says: "His name is Spine. He is heaven inside and hell outside." While attempting to solve this and other riddles, listeners are admonished not to stand openmouthed like the durian flower.

Folk healers treat a variety of ailments using all parts of the durian tree. An extract of the root is drunk and the remaining poultice applied to the head to treat fever. Jaundice sufferers boil the leaves, then put the water in a tub and climb in for a medicinal soak.

In Malaysia and other countries with recent deforestion, natural areas and the chance to view wildlife are becoming rare. Plantations like the one I was headed for offer tourists a chance to see a sample of resident birdlife while learning about the history and horticulture of the durian and other exotic fruits.

After several hours in a rolling cargo boat on the Andaman Sea, the potholed dirt road to the durian plantation in the mountains of Penang seemed smooth by comparison. My bus meandered comfortably through rubber trees, past idyllic creeks and waterfalls, through the village of Telok Bahang and on to Balik Pulau. Across a valley, stands of durian trees more than 130 feet high grew on hillside terraces of the plantation. It was late October. Durian season was rapidly waning, but scattered fruits still hung suspended from lofty branches awaiting harvest.

That day, I tasted a durian for the first time, surrounded by Malay workers intently watching my reaction. With a bush knife the headman broke a four-pound durian into five wedges that held the seeds in their beds of cream-white aril. The smell was overpowering, but the custard was smooth and intoxicating. In a few moments I felt the durian's true nature take hold as my pulse began hammering at my temples. My face flushed bright red as beads of sweat dripped from my

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Favorite Asian fruits, clockwise from top left: durian, lychee, mangosteen and rambutan.

brow. This *was* an intense fruit. One of the workers who was not completely doubled over with laughter passed me a durian husk filled with heavily salted water, which I gulped. The cooling was immediate and a great relief. I later discovered that mangosteens and rambutans, which my cabdriver had recommended, were even better antidotes. The trio of fruits captures the essence of the East, piquing the senses with a unique blend of color and design, taste and smell. One can hardly be eaten without the others. And they are often sold together, from roadside huts in Malaysia to the central markets of downtown Bangkok and Jakarta.

In the late 1920s American horticulturist Wilson Popenoe brought durians, mangosteens and rambutans to a valley on the north coast of Honduras. His employer, the United Fruit Company, was diversifying and had set aside several hundred acres in the lush Lancetilla Valley as an experimental introduction site for fruits, palms and hardwood trees from Africa and Asia. Hundreds of varieties of fruits were introduced at Lancetilla in hopes of finding viable crops to complement the market in bananas and pineapples, both of which remain important in Honduras. Though none of the Asian cultivars have replaced bananas and pineapples as cash crops, many have proliferated. Among the most spectacular plantings is a grove of 500 mangosteen trees. Each of the 50-year-old trees yields an incredible thousand pounds of fruit annually, some of which is air-freighted as far north as New York City.

In Lancetilla, durian and rambutan trees are scattered here and there on hillsides bordering the valley. I asked my guide, Baudilio Bayahona, for a durian. He grinned, rising to the challenge, and sent his sons off into the forest. In an hour or so they returned, sweating and dirty, after a 100-foot climb to the canopy. The smell of the two large fruits they carried had not yet reached its peak, but the stench was plenty strong enough to bring back vivid images of my travels in Asia. The Honduran campesinos who worked at Lancetilla laughed and turned up their noses as we strolled by with our quarry in hand, leaving the potent odor of durians in our wake. As I walked into the office the director requested that I leave the durians outside on the doorstep.

Baudilio told me of a Malaysian couple living in Venezuela who are seriously devoted to durians and are Lancetilla's best customers. Each year they make a 1,000-mile pilgrimage in time for the harvest to eat durians and revitalize their connections with home. They may be fanatics, but so are millions of other Asians, and a few of the rest of us, who share a passion for the world's strangest fruit.

Henry Genthe has written about sponges and the Sargasso Sea for SMITHSONIAN.

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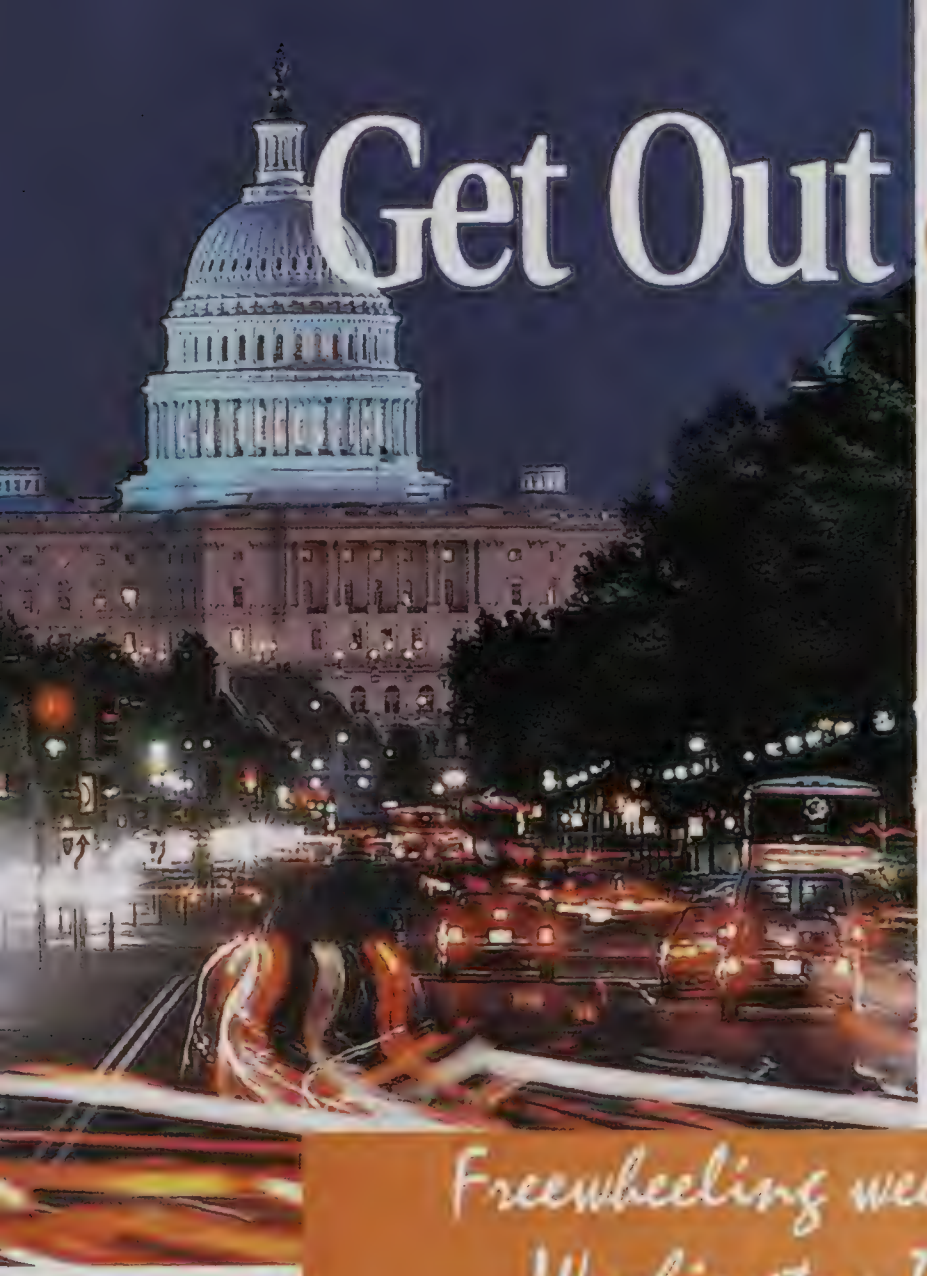

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OUT OF EGYPT:

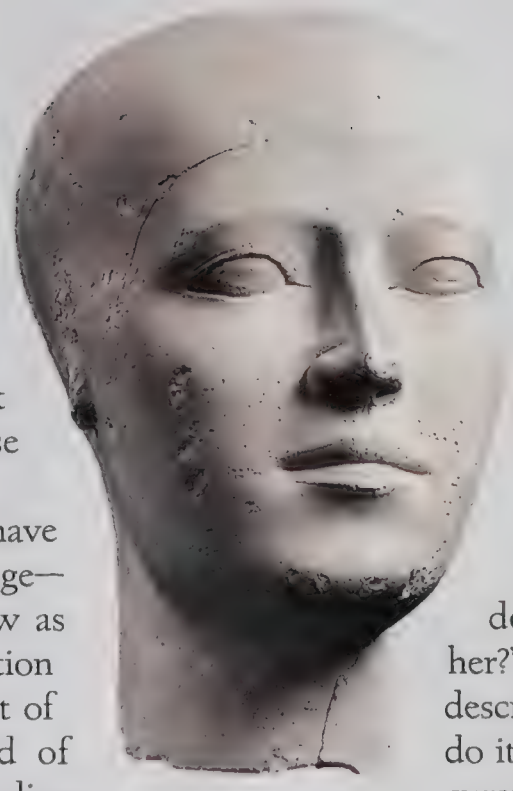
Art in the Age of the Pyramids

LONG BEFORE TUTANKHAMUN, CENTURIES BEFORE CLEOPATRA and Julius Caesar, in the age when the Great Pyramid of Giza was built and the Sphinx took shape above the sands, roughly 4,600 years ago, the pattern was already set for all that came in Egyptian art for millennia afterward. Aside from periodic raids by grave robbers, the great monuments slumbered quietly, well preserved by the dry climate and thick blankets of sheltering sand, as thousands of years slipped by.

Then, just 200 years ago, in July 1799, a young French engineer named Pierre-François-Xavier Bouchard, who was attached to Napoleon's Egyptian campaign, stumbled on a black basalt fragment of an inscribed commemorative slab, a stele. Installed today in the British Museum, the stone measures only 3 feet 9 inches by 2 feet 4¼ inches. It was deciphered by the Englishman Thomas Young and the brilliant young French philologist Jean-François Champollion, who made the final and definitive breakthrough in 1822. It came to be known as the Rosetta Stone for the town, today called Rashid, where it was discovered. Thus the key had been found to unlocking the written record of hieroglyphics that so precisely described the complexities and sophistication of

A LANDMARK EXHIBITION SHOWCASES THE CREATIVE GENIUS THAT BURGEONED DURING THE OLD KINGDOM ◆ **BY BENNETT SCHIFF**

Bridging centuries of Old Kingdom funerary art, Third Dynasty faience tiles from the first Egyptian pyramid provide a colorful backdrop for a Sixth Dynasty cedarwood statue.



ancient Egyptian civilization. Decipherment of the stone opened the door to the great series of excavations of Egypt's ancient tombs and pyramids—rough at first, but today a meticulous and precise system of archaeological techniques.

Since the early 19th century, scholars have assiduously created a body of knowledge—Egyptology—that has enabled us to know as much about that highly cultivated civilization as is known about any people in any part of the ancient world. That exacting field of knowledge is even today yielding new findings on this prodigiously researched sweep of ancient history, religion and culture.

For example, and to bring things right up to date, an extended trans-Atlantic dialogue among a group of eminent Egyptologists has led to the most comprehensive exhibition ever mounted of the art of the Old Kingdom, a period covering some 500 years, from about 2650 B.C. to roughly 2150 B.C. It was one of the world's most creative periods, the one that saw the rise of the Pyramids, the birth of the Sphinx and the creation of timeless statuary unsurpassed to this day for its massive simplicity, grace and elegance. These statues define the essence of what sculpture is—its three-dimensionality, its structural shape, its anatomy. For very good reasons the period came to be known to many as Egypt's first golden age, although, in fact, stone was more its medium of mastery.

Some 30 museums and collections in ten countries have contributed more than 230 masterpieces of the period never before seen together, for an exhibition that will be on display at New York's Metropolitan Museum of Art from September 16, 1999, through January 9, 2000. The show, titled "Egyptian Art in the Age of the Pyramids," opened at the Grand Palais in Paris, and from New York it will go on to Toronto, where it will be on view at the Royal Ontario Museum from February 13 through May 22.

It is an exhibition that looks forward by looking back. As described by Dorothea Arnold, curator in charge of the Department of Egyptian Art at the Metropolitan, it came about as follows: "It suddenly struck us that such an exhibition had never been done," she said. "It was a period that we had long taken for granted. Even we didn't recognize that the Old Kingdom had never been examined. A decade or so ago," she continued, "people started to rethink the era. We began to see it as not at all a finished story. From time to time reappraisals have to occur."

The idea for the exhibition, according to Arnold, began in Paris with Christiane Ziegler, head curator of Egyptian Art at the Louvre. "About three years or so ago Christiane had come to this conclusion, to do such a show. But would we do it with her?" There was a moment of silence, as Arnold describes it, and then, together, they said, "Let's do it!" And so, with Krzysztof Grzymski, senior curator of Near East and Asian Art at the Royal Ontario, three of the world's most respected Egyptologists embarked on the great project.

Together, the curators, who are familiar with tens of thousands of objects spanning some 5,000 years of ancient history, began the process of selecting the works that would illustrate the period in a way never before seen, juxtaposing one against another. In the end they chose 230 objects, which make up the exhibition.

To give an idea of the scope of this endeavor, the British Museum holds something like 100,000 objects in its Egyptian collection. From that number, 16 were chosen. The Louvre lent 15 from its vast collection. The Metropolitan, which also houses one of the world's most significant collections, contributed 35. The Cairo Museum itself let out 27 of its treasures. And so, from Brooklyn, Berkeley, Boston, Berlin, London, Turin and Oxford, from Cleveland, Chicago, Copenhagen, Detroit and Vienna, among other cities, the show was put together, taking some three years from conception to appearance.

"It was about time," said Arnold. "In this exhibition, we are able to show pieces side by side, many of them dug up together a century ago and now reunited in a different environment. It will be a period seen in a new light. We were so in awe of the period that we were reluctant to date things in it.

"We have been able to present a more complex view of the Fourth Dynasty at the time of the great pyramids, a time when Egyptian art was *set*! The basic framework of all to come was never changed; it was an achievement of an artistic framework, a set form, a canon."

The canon created for representing the human form was meant to convey specific information and as such was contrived to be read as if it were a condensed language

Tomb complexes yielded a plethora of statues. Above: Experts believe this limestone reserve head, with its finely sculpted features, is of a prince or princess. Opposite, clockwise from top left: Small-scale figures of a butcher slaughtering an ox and a potter at his wheel depict daily life; dark polished stone enhances a triad of a king and goddesses; a life-size statue portrays an aging, obese official.

COURTESY OF THE CARLSBERG GLYPTOTEK, COPENHAGEN; PHOTO BY JOHN BIGELOW TAYLOR, 1999 THE METROPOLITAN MUSEUM OF ART

BRUCE WHITE/ORIENTAL INSTITUTE OF THE UNIVERSITY OF CHICAGO (2); ROEMER- UND PELIZAEUS-MUSEUM, GERMANY; BRUCE WHITE/EGYPTIAN MUSEUM, CAIRO

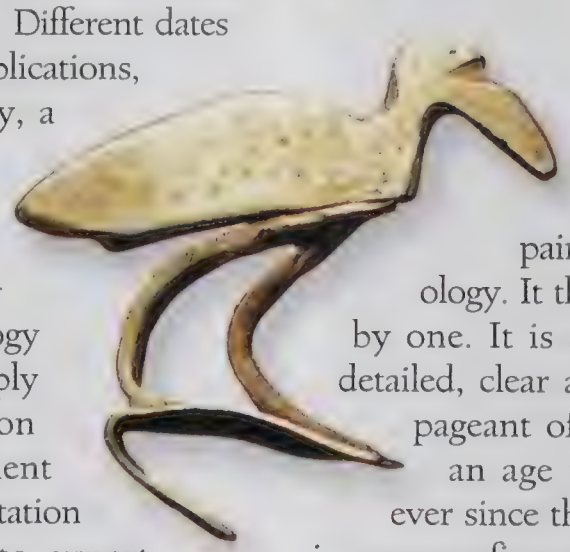
encompassing a system of rules and regulations. The code would provide ensuing artists for thousands of years with a specific way of depicting the human figure.

And so the head in reliefs or paintings was usually shown in profile, while the eye and eyebrow were presented straight on. While the shoulders and upper torso were also shown in full view—so that arms, hands and fingers were visible—legs and feet were depicted in profile. For those not acquainted with this unusual presentation of the human form, it took some getting used to. Today it is merely accepted as a decorative convention of Egyptian art.

What was remarkable, however, was the subtlety of expression and individuality that the ancient Egyptian artists were able to create within this framework.

"These artistic conventions set the way to show people: axial, not symmetrical, a frontal confrontation, a set number of poses," says Arnold. "It was almost like a language. Yet it was elastic, capable of any number of variations within the formula. It showed how creative the artist could be within the canon."

The exhibition encompasses the four dynasties of the Old Kingdom, spread out over 500 years, from the Third Dynasty, beginning about 2650 B.C., according to the Metropolitan's chronology, to the Sixth, which ended around 2150 B.C. The Louvre sets the dates at 2700 B.C. to 2200 B.C. The disparity is typical of the field of Egyptology. Different dates for the era are common in scholarly publications, encyclopedias and the vast bibliography, a library in itself, devoted to ancient Egypt.



The dating of specific objects and particular reigns of pharaohs, even given the most advanced scientific examinations, cannot yet be exact. A chronology of the Old Kingdom, then, becomes simply a guideline. What is known is based on documents from the period or on ancient historians' accounts. Even so, the interpretation of these sources differs from expert to expert. "Although royal registers exist, the length of each king's reign, and even the exact number of sovereigns, are still being debated," a booklet accompanying the exhibition explains. Depending on the documents consulted, the dates of any given event may vary within a range of 50 years, or for artworks as much as 200 years.

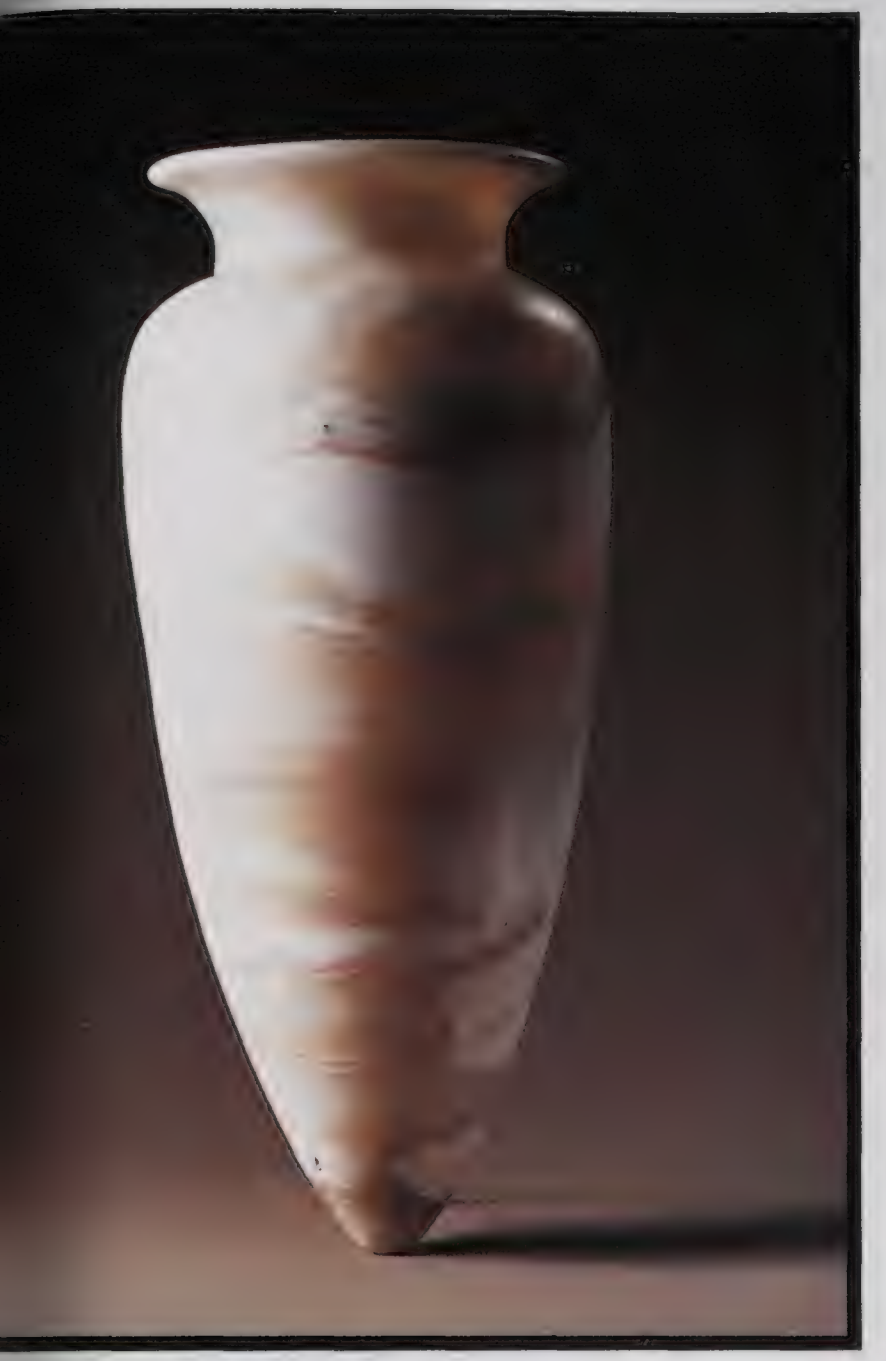
The current exhibition, however, shown chronologically, is easy enough to follow as the visitor walks through five centuries of the artistic evidence of a civilization, stopping here and there to be amazed.

The show is compartmentalized in the scholarly catalogue that accompanies it, which treats, in individual sections, the different aspects of the period: architecture, reliefs, paintings, statues, decorative arts and archaeology. It then proceeds to address the dynasties, one by one. It is a systematic and ordered presentation, detailed, clear and expository. It is also an illuminating pageant of a critical period near the beginning of an age that has fascinated the average person ever since the stories of early excavations for academic purposes first made the headlines in the mid-19th century.

Ancient Egypt, through the mystery of the mummies, the enigma of the Sphinx, the great and overwhelming force of the Pyramids, King Tut's treasures, Shakespeare's Antony and Cleopatra, not to mention Richard Burton and Elizabeth Taylor's, maintains its hold on our imaginations. The animated feature film *The Prince of Egypt* recently played in theaters throughout the world. And Hollywood is doing its best to show its worst in the horror film *The Mummy*, currently on motion picture screens. Last May, television put on its version of the Cleopatra story. Las Vegas has its Luxor gambling complex housed in, what else, a gargantuan pyramid.

"Egyptomania" in modern times came into being hard

TOBISCUITS MUSEUM; BRUCE WHITE/PHOEBE APPERSON HEARST



From left: The diverse tomb treasures include an ibis-shaped gold amulet (inset), which symbolized the god of wisdom; a well-preserved necklace of faience and gold leaf from Giza; an elegant alabaster vase possibly used in libation rituals; and two small monkey jars inscribed with the names of reigning kings of the Sixth Dynasty.

on the heels of the revelations of the Rosetta Stone. In the 19th century, hotels, banks, theaters, libraries and public buildings were designed in the "Egyptian" style. Popular fashion took up the theme in women's clothing and in hairstyles—short bob and bangs, pitch black—inspired by the wigs that were worn, low on the forehead, by the ancient Egyptians thousands of years before.

There is hardly anywhere today where there is not some evidence of old Egypt. The Maltese Falcon in the movie version of Dashiell Hammett's story resembles the prototypical Egyptian bird, representing Horus, the Falcon God. The eye engraved everywhere in Egyptian reliefs and paintings inspired both René Magritte and the designers of the CBS television logo. The ankh, the hieroglyphic cruciform symbol of life, and the cartouche, the oblong enclosure originally containing the names of pharaohs, were quickly taken up by jewelry designers.

The kilt is owned by the Scots today. Still, millennia earlier, a kiltlike garment was the basic item of dress in ancient Egypt for nobles and pharoahs, as pictured in countless reliefs, paintings and sculptures.

The Metropolitan Museum itself, proudly announcing the opening of its new and exhilarating Greek galleries, illustrated its full-page advertisement with a sculpture of a smiling Sphinx. Of course it is a Greek Sphinx with a Greek face and Greek wings but one which was likely based on Egyptian models, which preceded it by some 2,000 years.

And, for the most common derivation of all in the United States one has only to turn over a dollar bill. There is a pyramid, its peak wearing a halo of rays, topped with the prevailing eye, a holy symbol in ancient Egyptian religion representing the eyes of Horus and symbolizing the sun and the moon. It is now no less than the Great Seal of the United States. We carry ancient Egypt in our pockets every day.

Cleopatra's needles—red granite obelisks originally made 1,400 years before Cleopatra was born—stand some 70 feet high in Central Park, not far from the Metropolitan, and on the Thames embankment in London. Another obelisk rests in the heart of Paris, its top a gleaming gold pinnacle, a beacon near the Concorde Bridge midway on a line

METROPOLITAN MUSEUM OF ART (2)

Wearing a royal headcloth, the boy king Pepi II sits on his mother's lap in an affectionate pose with their hands touching.

between the Louvre (whose main entrance is topped by I. M. Pei's glass pyramid) and the Arc de Triomphe. There are several in Rome; one dating from 1297-1290 B.C. stands in the Piazza del Popolo. Even Washington, D.C. has its own version in the Washington Monument. Ancient Egypt is everywhere today.

Clearly, the curtain was raised on the grand pageant of present-day "Egyptomania"—a triumphal overture no less operatic than the opening of Verdi's Egyptian-inspired opera *Aïda*—in 1922, when the English archaeologist Howard Carter, after years of patient and unrewarding digging, came upon the tomb of the boy pharaoh Tutankhamun, a golden, bejeweled, blazing find. The treasure, when it was displayed to the public at the British Museum 50 years later, quickly became this century's first museum blockbuster (SMITHSONIAN, June 1972).

And when Lord Carnarvon, who had patiently subsidized Carter and was present at the opening of the tomb, died of pneumonia brought on by a blood infection from a mosquito bite, only six weeks after he entered the tomb, the scene was set for what became, in hyperbolic reporting, the "Curse of King Tut."

Popular stories of the time—that at the exact moment of Carnarvon's passing, the lights of Cairo went out due to a power failure and that his dog, at home in England, howled and died on the spot—did nothing to lessen the legend of the "Mummy's Curse."

The British archaeologist W. M. Flinders Petrie, whose early explorations helped codify a system of digging in the 1880s, also added to the mystique. Peter Der Manuelian, research fellow at the Museum of Fine Arts in Boston, in his catalogue essay on the history of the early archaeologists writes that Petrie was a serious scholar who obtained the most accurate measurements of the area up to that time by employing an intricate series of triangulations over the entire site of Giza. True to the tradition of English academic eccentrics, Petrie, while digging in the tombs at Giza, found it logical and convenient to take up residence in one himself. The archaeologist had the habit of wandering out of his tomb now and then clad only in his pink long johns, a ghostly vision guaranteed to petrify sightseers before launching them into headlong flight.

And there were the statues made of anorthosite gneiss which, writes Toronto's Krzysztof Grzymski, in a catalogue chapter on royal statuary, possesses a rare and astonishing optical property. It glows in sunlight, emitting a deep-blue radiance. The phenomenon is caused by the presence of the iridescent mineral bytownite. Since royal statues were not meant to be seen once they were sealed inside their tombs, it is easy to imagine the eerie effect when, dug up and exposed to the powerful Egyptian sun, they blazed away as if they were internally irradiated by some demonic spirit.

Adding to the mystique was the elemental idea, going back before the Old Kingdom, that such statuary was

BRUCE WHITE/BROOKLYN MUSEUM OF ART

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The vizier Kai is commemorated in a painted limestone statue with inlaid eyes of stone and rock crystal.

inhabited by the *ka*, the spirit of the deceased, which was free to roam around the tomb.

Such statues, writes Dieter Arnold, curator of Egyptian Art at the Metropolitan, had a "powerful but secluded existence. . . . " Statues were containers for the "living *ka*, the actual life force of gods, kings and human beings." They were therefore powerful and even dangerous. At the same time they were vulnerable and needed ritual treatment for their survival, thus they were focal points for cultic rites presided over by priests.

And here is the principal motivating force and spirit of the entire civilization, the electrifying idea that the very purpose of life was to prepare for the afterlife, a cherished state of continuing to be. It was because of this central driving force that what we value so highly, and treasure as art, was in fact produced. It is also why some of these artworks were not even meant to be looked at.

Today it is not easy to stop looking at the statuary gathered in this exhibition, for its formal mastery, for the magnetizing force of the personalities the statues represent and for the expressive power of the stony materials themselves. The various substances range from the delicate Egyptian alabaster (not a true alabaster but a form of calcite) to a dramatic mottled rose granite, a dense black basalt, a roseate quartzite and a smooth-as-silk greenish-gray rock called graywacke.

There is still some question, raised by certain experts, as to whether the Third Dynasty belongs to the Old Kingdom. Nevertheless it is clear that the reign of Djoser (2630-2611 B.C.) marked the transition to the sophistication that characterized the Fourth Dynasty, the period that put its mark on all succeeding dynasties. It was Djoser who, with his vizier, Imhotep, as his architect, built the gigantic step pyramid at Saqqara; it consisted of six massive steps, rising about 200 feet, and measured 358 by 397 feet at its base.

The Old Kingdom was really launched in the Fourth Dynasty, during which the pharaoh Khufu (also widely known by his Greek name, Cheops) and his successors codified the structure of Egyptian society. The canons regulating art were also formulated in these years and remained relatively constant for the next 2,000 years.

Ancient Egypt during this time was already a highly organized agricultural society, benefiting from the fertile Nile floodplain and a system of canals and dikes, and water and land management. All was run by an efficient bureaucracy whose tax collections funded such enormous projects as the building of the Pyramids.

These gigantic architectural undertakings, undisputed marvels of engineering and mathematics, required huge workforces—artisans who were regularly employed in pharaonic workshops, skilled workers and unskilled laborers, who were largely conscripted farmworkers put to work during flood time.

The entire structure of the society, its very purpose, was centered on maintaining the order of the universe to ensure a good existence in this life and a blessed continuation of one's earthly status in the afterlife. The tombs of the nobles and of their ranking functionaries were, therefore, a vital force in the culture.

It was Khufu who built his enormous resting place, the Great Pyramid at Giza, dwarfing Djoser's step pyramid at Saqqara. Almost 500 feet high and covering 13 acres, Khufu's pyramid was the largest ever built. Commemorating his reign, it was the centerpiece of his necropolis. Which is not at all to say that it was moribund.

In keeping with the religious beliefs of the time, the place was a beehive of activity, with the spirits of the departed busily engaged in continuing the comforts, occu-

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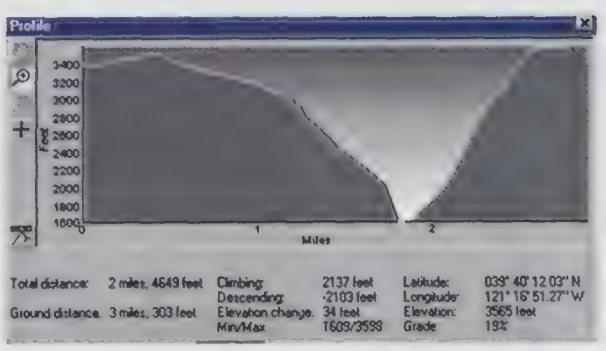

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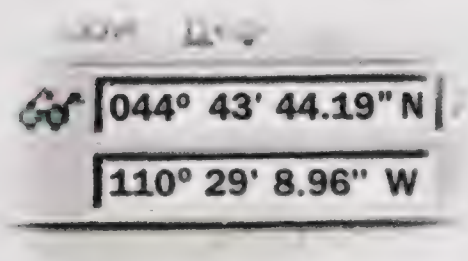

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pations and pleasures that they had enjoyed while they were alive. Once a pharaoh was interred in his pyramid, it was never meant to be entered again. But, in the temples of the tomb complex, an entire society of priests and acolytes attended to the daily rituals that provided for his eternal life.

Here nobles and high functionaries who could afford it had tombs built for themselves and their families. A tomb in the royal necropolis offered the deceased the hope of gaining eternal survival, as well as the continuation in the afterlife of his duties to the king.

Ancient Egyptians "regarded the preparation for their welfare after death as a major task to be undertaken during life," writes Peter Janosi, of the University of Vienna, in the catalogue. "Providing for the afterlife meant not only building a tomb and equipping it with the necessities but also establishing a mortuary cult maintained by individuals who would provide for the requisite offerings and perform the essential rituals after the tomb owner was buried. Certainly, preparing for life after death involved one of the largest investments Egyptians had to make."

The tombs—called mastabas after the Arabic word for rectangular mud benches—gradually evolved into elaborate structures embellished inside with statuary and intricate reliefs in the most graceful and sophisticated of designs. Nearby were smaller pyramids built for Khufu's wives.

Beginning in the late Fifth Dynasty and continuing through the Sixth, Pyramid Texts were inscribed on the walls of the chambers to help the departed pharaoh along on his voyage to eternal bliss. These inscriptions included magic incantations. "The Egyptians believed that rebirth could be achieved through three primary avenues," writes Audran Labrousse, director of the French archaeological mission at Saqqara. By the first, the deceased reaches the underground world of the dead, ruled by Osiris. By another path, the solar one, the pharaoh is reborn every morning and accompanies the sun in his ship across the sky. By the last, the pharaoh rises at night and joins the stars that circle the pole.

Wall reliefs, notable for their linear grace and sculptural mastery, also provide remarkably accurate records of nature. There are birds and flowers so exactly rendered that biologists today can identify their species. These reliefs were, in effect, murals carved in stone to ensure the eternal life of the entombed ruler or noble. The full range of his activities and the life around him were depicted to accompany him in the afterlife and document his having lived a successful and just life.

There is also a revealing record of more common life in small-scale, perfectly realized sculptures of people going about their duties. The exhibition includes statues of a potter, a butcher and a cook. Reliefs also depict activities such as hunting and farming. There are stunning examples of jewelry and metalwork as well.

Four sculptural heads displayed in the show are mysterious even to today's experts. Speculation abounds as to what they signify. Only 31 such pieces have been exposed to date. The first, an early Fourth Dynasty find, was uncovered at Dahshur in 1894, one of four discovered outside the necropolis of Giza. Giza itself yielded 27 over the years.

These extraordinary objects, called "reserve heads," are portraits that could have come out of a futuristic movie. They are, quite simply, heads that terminate at the base of the neck. Likenesses of the deceased, they were at first thought to serve as spare—"reserve"—heads for the departed should the real thing be lost or damaged.

Other theories suggest that they were magical sculptures used in funeral rites. Most of the heads seem to have been intentionally mutilated, including the removal of the ears. Or, they could have been used as sculptor's models, and the damage may have occurred when the molds were broken. For now, and until some written record is discovered, all is speculation. In any event, sculpturally, they are remarkably impressive, at times hauntingly beautiful.

In Paris, at the conclusion of this extraordinary exhibition, there was a placard reminding visitors that many of the masterpieces of the Old Kingdom—their specific dynasty and cultural context—are still an "enigma." Indeed, the true curse of Egyptomania is self-inflicted. The need to know more casts a spell. As the seeker of further knowledge gathers facts, the field, at the same time, expands. New finds lead to new questions. Reversing the familiar dictum, it is not that less is more but that here, in the symbol-laden world of pyramids and hieroglyphs, more becomes less.

And that, perhaps, accounts for the inscrutable smile of the Sphinx.

In writing this article, contributing editor Bennett Schiff took his first conscious look at the back of a one-dollar bill.

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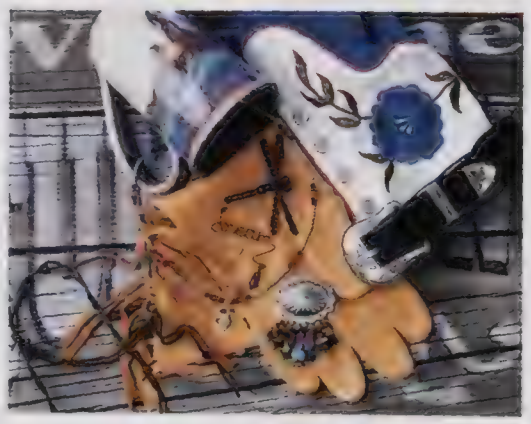

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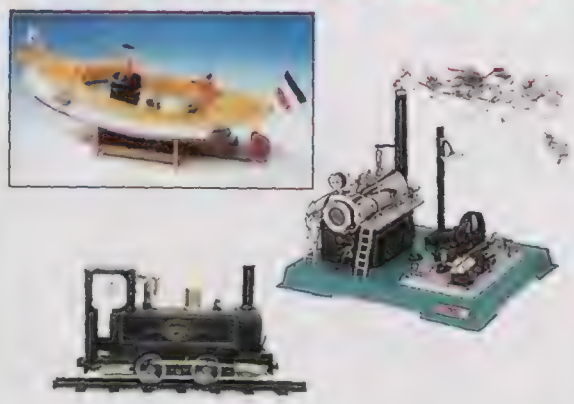

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Strawmen & Beastie Boys

Hansel and Gretel's witch may be toast, but strange and scary creatures still roam the hinterlands of Germany. In the rural villages of the south, the Eifel Mountains of the west, and Thuringia in the east, Christian holidays are marked by festivals revolving around centuries-old folk characters, such as the Advent "Buttnmandl" (left), who stomps and growls his way through Berchtesgaden in the Bavarian Alps to chase away the demons of winter—and woe to the child who tries to steal some of his lucky straw. Or the leafy "Pfingstkäs" (above), a cone-shaped figure whose Pentecost parade through Breisgau in the Black Forest celebrates the rebirth of Christ and of the earth. Some historians believe these folk characters have pagan roots, while others think they originated in medieval courtiers' games. Gradually, they were adopted by the church, and now blend religious and agrarian themes. Since 1997, ethnologist and photographer Markus Bullik has been capturing these wild spirits, many unknown outside their own communities, in a pictorial documentary, "Folk Figures of the Village Society." A book and exhibitions of his photographs, in collaboration with Hamburg's Museum of Ethnology, are scheduled for 2000-2001. If you go, be sure to leave a trail of bread crumbs.

—Suzanne Crawford

PHOTOGRAPHS BY MARKUS BULLIK

At Mid-Lent in the Markgräflerland, in southwest Germany, a "Hisgier" (above) prepares to battle winter's evil spirits. A cloth will cover his face as he leads a procession through the streets, accepting offerings from which a feast of cakes will be made. His French infantry hat and sword reflect the nearness of France, which occupied the area in the 1700s. Thuringia's "Strohbär"—Straw Bear—(unmasked at right) collects eggs, sausages and money for a Pentecost feast. His suit will then be thrown into the river, to wash away winter's dead and welcome new growth.

Looking like a medieval spaceman, a Hisgier (top) descends on a Markgräflerland town on Easter Monday to banish lingering winter demons; special grains provide the long, flexible stalks for Hisgier costumes. Winter concedes defeat at Pentecost, when the "Maimann"—May Man—(above left), found only in Hesse, and the "Latzmann" (above right) wend their uncertain way through rural hamlets. All too soon winter returns, and at Advent in Bavaria the "Klausen" (right) run wild, rattling windows and jostling villagers until Saint Nicholas arrives on December 6.

"For a while . . ."

THEN THE FULL FORCE OF THE STORM HIT. BY THE TIME IT HAD PLAYED ITSELF OUT, GALVESTON, TEXAS, WAS A SHAMBLES

THE DEDICATED WEATHERMAN AND THE TERRIble storm collided during the first week of September 1900. Isaac Cline, head of the U.S. Weather Bureau station in Galveston, Texas, was tracking a hurricane headed northwest through the Caribbean. Cline was fascinated by the young science of meteorology; after 18 years in the Weather Bureau, the last 11 in Galveston, he knew his field well. He expected this particular tropical cyclone, once it passed across Cuba, to run up the Eastern Seaboard of the United States. But it hit a stubborn high-pressure block over Florida and veered west. The last information Cline received placed the storm south of Louisiana as it screamed across the Gulf of Mexico toward Galveston.

In the roll call of America's deadliest disasters, the body count becomes a grim Richter scale. Think of the 250 people killed in the Chicago fire of 1871, the 1,182 in the forest fire at Peshtigo, Wisconsin, in that same year, the 503 in the San Francisco earthquake of 1906, and then, even worse, the 1,836 lost in the Florida hurricane of 1928, and

BY STEPHEN FOX

After the 1900 hurricane, only a few houses were left standing on the southeast side of town. Some 8,000 people lost their lives.

. . . it was fun"

the 2,209 in the Johnstown flood of 1889. Yet the total deaths from these five catastrophes, taken together, amount to thousands fewer than the toll inflicted by the Galveston hurricane one year short of a century ago.

It seemed obvious, afterward, that Galveston was vulnerable to calamity. The city perched on the eastern end of a barrier island—an exaggerated sandbar—a few miles off the Texas coast. Its main street, Broadway, bisected the city along the island's spine from northeast to southwest. At only 8.7 feet above sea level, Broadway offered the highest land in Galveston. Facing the Gulf, a wide, level beach ran the length of the island—27 miles of glistening white sand. To improve beach access, protective sand dunes up to 15 feet high had been removed along the city's edge. A traveler approaching Galveston from the Gulf first glimpsed its buildings seemingly floating in water, mirage-like, with no land in sight.

Geography had made the place both attractive and dangerous. Constant sea breezes kept its summer weather more temperate than on the neighboring Texas mainland,

Survivors picked through wreckage near a house that had been knocked off its foundation by wind and waves. An area of total destruction began just a few blocks away.

drawing thousands of visitors. On the north side of town, on Galveston Bay, a new deepwater harbor promised a prosperous future. The federal government had recently spent $7 million on dredging and building jetties to deepen the channel from the Gulf into the bay. The harbor's cotton and grain exports had made Galveston, linked by railroad bridges to the mainland, the major banking and financial center between New Orleans and San Francisco. Impressive Victorian mansions were sprouting along Broadway, and new residential areas were spreading to the south and west, toward the unsheltered beach.

As resort, port and mercantile center, Galveston radiated a cosmopolitan ease. It included many citizens of German, French, Jewish and Italian ancestry, the first synagogue in Texas, and the seat of the state's oldest Roman Catholic diocese. The three leading Galveston merchant families were Protestant, Protestant, and Jewish. About 22 percent of the population was black. With power so diffused, nobody really dominated. The Artillery Club, formal and exclusive, lay adjacent to the fanciest whorehouse in town. People came to Galveston to enjoy themselves amid the oleanders and public gardens. Young swells took to oyster roasts, boat sails and fishing parties. For other tastes there were a dozen public gambling houses and many unregulated saloons that never closed. Bathhouses and refreshment stands lined the beach. Nude bathing, popular with both men and women, was restricted by city ordinance to late at night.

It was a place apart. Insularity bred both pride and complacency. At regular intervals, and particularly in 1875 and 1886, high water had swept over Galveston. These "overflows" were accepted as part of the island's uniqueness; with no great damage done, residents mopped up, cracked jokes and went on as before. Sensible proposals to build a protective dike around the city had gone nowhere. The famous beach sloped off to deep water so gradually that (it was understood) destructive waves from the Gulf would surely break and be spent before reaching shore.

Isaac Cline, not a native, had his doubts. Thirty-eight years old at the time of the storm, he had grown up on a Tennessee farm and after college joined the agency that would become the Weather Bureau. While rising through various postings, he also earned a medical degree in order to study weather's effects on the human body, published and edited a newspaper, campaigned for temperance, and finished another doctorate, in philosophy and sociology. Cline met his wife, Cora, at the Baptist church where she served as organist. They had three young daughters, and Cora was well into her fourth pregnancy. Given Galveston's history of overflows and hurricanes, Isaac Cline had

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built his family an exceptionally strong frame house a few blocks from the beach, with the first floor built above the high water mark of 1875.

On Friday, September 7, he scanned the sky over the Gulf. For several days, he had been receiving storm-warning advisories from the Weather Bureau's headquarters in Washington, D.C. He had not observed, however, any of "the usual signs which herald the approach of hurricanes," he later wrote in a report on the storm.

He saw no "brick-dust sky," usually a reliable clue to approaching hurricanes in that area. Barometric pressure had fallen only slightly. The first real harbinger, a heavy swell from the southeast, arrived in the afternoon and continued through the night. The tide rose unusually high despite fighting strong opposing winds from the north and northwest.

At 4 o'clock Saturday morning, Cline's younger brother Joe, who roomed with the Clines and also worked at the weather office, awoke with an inexplicable sense of impending disaster. The backyard, he saw, was flooded. Alerted by his brother, Isaac drove his horse and wagon to the Gulf, where he timed the swells, and then went to his office in the city's commercial section. He found the barometer had dipped only a tenth of an inch since 8:00 P.M. the night before. He returned to the beach to gauge the tide and swells again before sending a telegram to Washington: "Unusually heavy swells from the southeast, intervals one to five minutes, overflowing low places south portion of city three to four blocks from beach. Such high water with opposing winds never observed previously." Again he went back to the beach, warning people to move inland to find shelter.

Light showers fell during the forenoon but didn't prevent thousands of people in fancy clothes from visiting the beach to watch the booming, crashing surf. Some even went swimming. Children played with driftwood boats in the flooded streets. "For a while," Louisa Christine Rollfing recalled, "even ladies were wading in the water, thinking it was *fun*. The children had a grand time." A holiday spirit persisted until the bathhouses, extended into the Gulf on pilings, broke apart. Then the streetcars stopped running. Moods and skies began to darken. ("Then it wasn't fun any more," Rollfing noted.)

A heavy, persistent rain started around noon as the barometer plummeted and winds grew stronger. The hurricane was aiming dead at Galves-

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In Galveston Harbor (below), the storm bashed warehouses, piled wreckage atop piers and drove ships aground. Within days, vessels were again unloading freight. Two houses occupied by Italian families (above) suffered minor damage in a ruined neighborhood.

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The Wonder of Iron-11

Though mankind has used iron for 5,000 years this common metal is now at the frontier of discovery, which is revealing many fantastic properties.

Toward Rust-Free Iron

By Yoshiyuki Matsuo

Everyone knows that iron rusts after awhile. However, this basic assumption is being challenged by leading-edge research. At the Research Institute for Iron, Steel, and Other Metals in Sendai, Japan, scientists have developed iron which, though refined in August of 1988, has no rust at all and shines like a precious metal. The secret of rustless iron lies in an extremely high 99.995% refinement level.

The latest experiments show that iron's tendency to rust is reduced simply by reducing the level of impurities. The creation of alloys calls for adding elements, while the making of pure iron is actually a subtracting process. In fact, all the steel products we use today are essentially made of a variety of iron alloys. Steel sheets used in an autobody have high workability, whereas cast iron used in the engine is highly rigid and strong. Though made of the same material, steel products can demonstrate totally different properties. This is the reason why iron has been called by many the "king of raw materials."

We still haven't obtained totally pure iron. The highest purity to date is 99.995% pure. This level of purity is six factors of ten lower than 99.999999999% purity of the silicon used for electronic substrates. However, 99.995% pure iron is already showing us some amazing truths. For example, tension tests at an extremely low temperature of only 4.2 degrees above absolute zero show plastic deformation and no splitting.

Mankind first obtained iron around 3000 B.C. However iron is even now a technological frontier hiding an infinity of possibilities.

About the Author:
Yoshiyuki Matsuo is a senior editor for Nikkei Science, *the Japanese version of* Scientific American. *His special interests in material science include quasicrystals, C_{60}, and superconductors.*

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ton. All bridges to the mainland were underwater. Boats were useless in such conditions. No one could leave the island. The city's telephone, electric and gas utilities blinked out. People waded and swam away from the encroaching surf toward the slightly higher ground midtown. "The Gulf," Katherine Vedder Pauls said years later, "looked like a great gray wall about 50 feet high and moving slowly toward the island." Finally sensing danger, with the hurricane bearing down on them, Galvestonians were trapped on their sandbar.

At midafternoon Isaac Cline waded nearly two miles to home. The air was filled with flying bricks, masonry, roof slates, timbers, even entire roofs. Dodging those missiles, Cline also skirted downed electric wires, some sputtering and burning like long, sulfurous snakes. At home he found the water around his house waist deep. About 50 neighbors crowded in, drawn by the house's sturdy construction. When Joe arrived, the brothers stepped outside. Should they seek shelter inland? Isaac was loathe to move Cora, pregnant and ill at the time. Aside from the wind and water, the airborne debris might harm his three little girls. The house was built to stand. A sudden rise in water forced the decision to stay put.

Thousands of desperate individual dramas unfolded. Henry Johnson, a black laborer recently arrived in Galveston, took refuge in his boardinghouse near the center of town. The wind rocked the house back and forth "like a barrel," Johnson remembered. When the back porch collapsed, with the house likely to follow, he fled outside. Neighborhood men helped people leave by pushing clumps of debris out of the way with long poles. White or black, Johnson said later, it made no difference; everyone was treated alike in the crisis. Someone took him to the Union Railroad Passenger Depot, a substantial public building. It was already crowded with refugees and their animals. For hours people kept straggling in, many naked and bleeding, with broken arms, some crying a wild gibberish. Windows broke but somehow the depot itself held.

The fury of the storm demolished Sacred Heart Church; two stained-glass windows and the crucifix were all that survived.

Giuseppe and Concetta Rizzo, immigrants from Italy, lived near the beach in the east end of town. Their grandson, Jimmy La Coume, a lifelong Galvestonian now 71 years old, recounts the story as it has passed down through the family. One of Giuseppe's brothers came to the house in a rowboat. He only had room for Concetta and her daughter, Jimmy's mother, then 7 years old. "OK," said Giuseppe, "come back for me." Before the boat could return, the house was swept away and Giuseppe was lost. Concetta and her daughter went to the nearby Sacred Heart Church, where the dome soon collapsed, and then to Saint Mary's University where, on the second floor, they rode out the storm, wondering about Giuseppe's fate.

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Terrifying sounds came in relentless waves and pulses. The wind shrieked and whistled, driving the rain and groundwater. Whitecapped waves six feet high coursed up Broadway. The slanting rain, cold and sharp, felt like needles or glass splinters in the face. When slate shingles were torn off a roof, to the people cowering inside, it sounded like a freight train passing over the house. The buildings themselves seemed to be crying amid the cacophony of breaking glass, falling walls, rattling tin roofs, and wooden rain cisterns rolling and tumbling. The spire of St. Patrick's Church, the tallest structure on the island, rocked and swayed for hours, then fell in a wind gust so loud that nobody heard the tower crash. In momentary lulls even more terrible sounds became audible: cries for help, usually unanswered and unanswerable, from the dying and drowning.

The storm leveled all social distinctions, but it could not erase all cultural differences. The wife of Clarence

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Ousley, editor of the *Galveston Tribune*, had never truly accepted her neighbors the Niccolinis because—as Ousley's daughter Angie later put it—"they spoke English with difficulty and also used a trifle too much garlic in their cooking." The Niccolinis, "all extremely vocal," arrived seeking shelter. The Ousleys gave them a bedroom of their own.

A few blocks from Isaac Cline's house, the Ursuline Convent and Academy took in nearly a thousand refugees. When part of the north wall fell in, about a hundred blacks started to shout and sing in "camp meeting" style. Whites unaccustomed to this kind of worship grew restive and irritated. Tempers, drawn so taut, started fraying. Mother Superioress Joseph rang the chapel bell, hushed the crowd, and told them that God would hear their silent prayers, from their hearts, even through the hurricane. Everyone settled down to endure the storm together.

Shortly after 5 o'clock, the anemometer at the Weather Bureau recorded gusts of 100 miles an hour, then blew away. Isaac Cline later guessed the wind peaked at 120 miles an hour. George McNeir, captain of the sloop *Cora Dean* in Galveston Harbor, was sure it actually hit 150 miles an hour. When McNeir went aloft to clear mastheads in the ship's rigging, a tremendous gust of wind tore his feet from the lines and hung him out horizontally, like a pennant, until the gust subsided and he could continue climbing.

The hurricane crested in the early evening. "As darkness came on," Walter Davis later wrote his mother, "the Terror increased." With the storm roaring at its height, and no electricity or gas, people relied on candles and kerosene lanterns—and occasional flashes of lightning—to see by. Otherwise the blackness was complete, adding visual isolation to already-desperate straits. The wind shifted to northeast and then east,

Initially bodies awaited identification at a makeshift morgue. Many corpses were disposed of at sea; when they floated back, as many did, they were cremated at once.

reinforcing the building tide from the Gulf. A massive storm wave broke on the island. At 8:30 the barometer bottomed out at 28.48 inches, the lowest pressure recorded up to that time at any Weather Bureau station.

Floating clumps of wreckage, joining and separating, careened around and slammed into buildings. The Cline house held up under this fearsome battering until Isaac, bunkered with his family on the second floor, saw a long piece of streetcar trestle crash squarely against the side of his home. The house creaked, tipped over into the water and started breaking into pieces. Joe Cline, holding his two older nieces by their hands, turned his back toward a window, pushed from his heels, and broke through the glass and storm shutters. They found themselves floating on a piece of the house. No other survivors could be seen.

Isaac, Cora and their youngest daughter were thrown against a chimney, then into the bottom of the wreckage. Isaac, pinned down, expected to die. "It is useless to fight for life," he remembered thinking. "I will let the water enter my lungs and pass on." He lost consciousness; but by some mysterious shifting of the ruins he was propelled upward and came to with his body wedged between heavy floating timbers. During a flash of lightning he caught sight of his youngest girl on wreckage a few feet away. A few minutes later, another flash revealed Joe and the other children. Cora was gone, somewhere down below. The surviving Clines struggled onto the best piece of flotsam they could find.

For the next three hours they drifted out of control, switching from clump to clump as their fragile rafts broke apart. Placing the children in front of them, the men turned their backs to the wind, holding up planks for puny shelter. Still they were repeatedly hit and bloodied. An especially heavy blow would knock them into the water and they would struggle back to the children.

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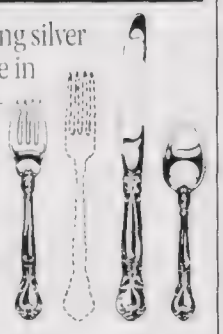

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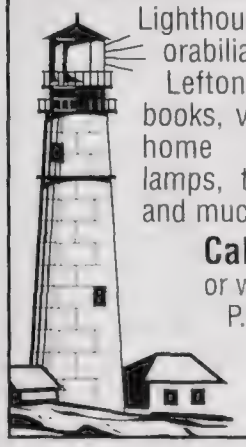

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explanation, the family dog—a fine hunting retriever—appeared from nowhere and clawed his way onto the wreckage. The dog frantically smelled each of the Clines and, unsatisfied, dashed to the edge. To Joe it seemed that he was looking for Cora. The dog poised to jump and resume his hopeless search; Joe shouted and lunged for him, but he darted away and was gone. "I can almost believe to this day that animals have superhuman senses in time of danger," Joe wrote years later. "We never saw him any more."

Both humans and animals performed heroic feats under pressure. Daniel Ransom, a paperhanger and a strong swimmer, spent 2½ hours in the water, leading and carrying 45 people to safety at a large brick building. At Saint Mary's Infirmary, Joseph Corthell, a harbor pilot, and his brothers used a lifeboat to ferry more than 150 people from the neighborhood to the hospital—until their boat sank. Also at Saint Mary's, a medical student, Zachary Scott, carried more than 200 patients from outbuildings to the main structure, wading through water that eventually reached a depth of six feet.

Each hero had to make the essential fateful decision: whether to hang back in self-preservation or dare the howling maelstrom, at grave personal risk, to try to save others. Harry Maxson, 14 years old, lived with his family on the west side of town. Their house was the last remaining refuge in the neighborhood. Late that night, during a lull, Harry raised a kitchen window and listened. "I heard what I didn't want to hear," he wrote years later, "a woman yelling 'for God Sake come and save us, our home is falling to pieces.' I shut the window as quickly as I could and tried to forget that woman's voice. It was awful so far away and still so penetrating; it made me shake all over." In the next lull he opened the window again and heard the voice cry, "I can see the lights in

Isaac Cline, chief meteorologist in Galveston when the storm hit, later became head forecaster in New Orleans. He opened an art shop there when he retired.

your house." That brought it home: he had to go.

Harry told his father but could not bear to say goodbye to his mother, and set out with another man. They rode the waves toward the woman's house, which was floating and breaking apart. Inside were 13 children and 23 adults. Harry shouted that they would take the kids first, calling on each man in the house to accompany them with one child. "The longest silence I ever heard," Harry recalled, "but no one came out or even said 'boo.' . . . The men in the house were paralyzed with fear." At last a large black man appeared with a white baby, followed by the other men carrying children and some of their wives. They struggled single file, each man holding on to the next, to the Maxson house. Harry and several men undertook another trip to rescue those who remained.

The Clines drifted out to sea. They saw no houses, lights or people for two hours. Then the wind shifted to the south and blew them back to shore; they landed only 300 yards from where they had started. All were frightfully bruised; one of the girls was barely alive. They dragged themselves into a house with no roof or ceiling, and collapsed for the night, bone-weary and hurting.

Sunday arrived with a beautiful sunrise and calm ocean. As survivors crawled out, looked around and got their bearings, the magnitude of the disaster was slowly revealed. It was too much to take in quickly. "There was little talk," Katherine Vedder Pauls recalled. "All were stunned by the catastrophe." About one-third of the city, mostly in sections near the Gulf, was completely gone: no houses or even streets were left, only scoured sand. Along the upper edge

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These days the Galveston port attracts tourists with restaurants, hotels and a theater that portrays the tragedy that took place there nearly a century ago.

of that vast emptiness, a three-mile windrow of wreckage, up to two stories high and 100 feet thick, had been formed: a mass of lumber, debris and mangled corpses. In the rest of the city, hardly a building was left undamaged, and many had disappeared altogether. More than 3,600 houses were destroyed.

The retreating water left a thick slime, rank and penetrating. In the harbor, the steamship *Roma* had torn loose from its mooring, crashed into two large piers, smashed broadside through all three railroad bridges and lay stranded in mud. Docks, warehouses and grain elevators were wrecked or severely damaged. Boats of all sizes were scattered around. With telephone and telegraph wires down, one of the few boats still seaworthy was dispatched to the mainland bearing the first grim news.

Bodies, torn and naked, were everywhere: in yards and streets, caught in trees and random structures, floating in the bay. "Put your foot down," Henry Johnson recalled, "an' you put it on a dead man." Some kept their children indoors to avoid the searing sights. In one house, 13 of 15 people had died. One family lost 28 relatives; another, 42. "Every one here seems *stunned*," Eleanor Hertford wrote her future husband, "and you never see any emotion displayed of any kind, every one is perfectly calm! We all seem to have gone through so much, that we seem beyond tears!" Survivors told each other matter-of-factly of crushing family losses. "All gone," they said, all gone.

The first estimate on Sunday was 500 dead. Bodies were borne on stretchers to temporary morgues. As corpses kept turning up, the estimate went to 3,000. The saturated ground prevented mass burial. Polite formalities had to be suspended; bodies were piled on wagons without ceremony, taken to barges and dumped at sea. When they floated back to shore, immediate cremation became necessary. (In the 80-degree weather, the foul stench of putrefying flesh quickly became overwhelming.) For a month, about 70 bodies a day were found among the piles of wreckage. Most of them were simply doused with oil and burned on the spot with the debris. The soundest contemporary estimate placed the final toll at 6,000 in Galveston, a thousand elsewhere on the island, and another thousand on the mainland: a total of at least 8,000 dead, a figure accepted in recent years in studies published by the National Oceanic and Atmospheric Administration.

In the immediate chaos that followed the storm, some looting took place. Giuseppe Rizzo's body was found with $500 missing from his money belt. An emergency guard force was soon overwhelmed. Robbers pillaged through property, staged daylight holdups, and cut the ears and swollen fingers from corpses for the jewelry. Looters were shot on sight: perhaps a dozen, perhaps scores. No records were kept. "Tuesday I went round with a pistol," Sarah Davis Hawley wrote her mother, "as so many people had been killed while trying to protect their things. Ah you can never realize the awfulness of it all." Gunfire punctuated the nights. Reports of looting continued until Thursday, five days after the hurricane, when martial law was officially

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imposed to restore order to the city.

Several days after the storm, Ella Sealy Newell heard a boy whistling. "We all stopped to listen," she noted. "It was the first joyous sound we had heard; anything gay or bright in dress, or manner, seems utterly out of place." As time passed, most Galvestonians absorbed their losses, picked through the debris and resumed living. Isaac Cline, with Cora still missing, went back to work with his head bandaged and a foot poulticed. In his formal report, he recounted his own experiences in flat, declarative tones. "Among the lost," he wrote, "was my wife." As to the future, "I believe that a sea wall, which would have broken the swells, would have saved much loss of both life and property." Cora's body was found a few weeks later, identified by her engagement ring.

Over the next decade, a seawall was finally built and most of the city's grade was raised. Hurricanes have continued to pound Galveston every now and then but without the disastrous losses of the 1900 storm. That dreadful catastrophe reminds us of the folly of underestimating the power of nature, even in the most modern of circumstances. Its upshot also suggests the stubborn resilience of human will in the face of calamity.

On Sunday morning following the storm, a baker named Bernard La Coume had opened his door and discovered a barrel on the front porch. His son, Clarence, later told the story many times to his granddaughter, Linda Macdonald, who lives in Galveston today and relates the anecdote with relish. Bernard tapped the barrel and found that it was filled with wine. "Don't ever forget," he told Clarence, "that even in times such as these, the Good Lord remembers the needs of a Frenchman."

Stephen Fox is a historian and biographer who lives near Boston. His story about California train robber Chris Evans appeared in the May 1995 issue of SMITHSONIAN.

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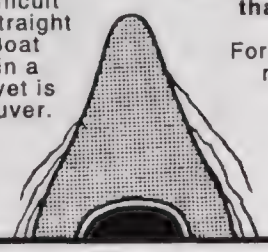

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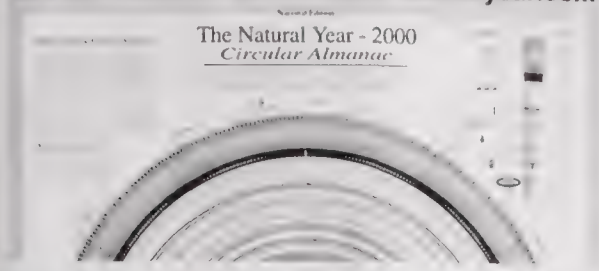

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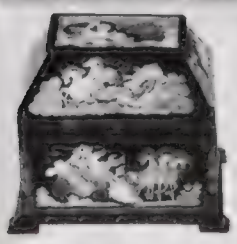

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All You Need Is Love: The Peace Corps and the Spirit of the 1960s

Elizabeth Cobbs Hoffman

Harvard University Press, $27.95

IN AUGUST 1961, TWO WEEKS AFTER the Berlin Wall was built, a Pan Am propjet taxied onto the airport tarmac in the capital of Ghana. Stepping from the plane, 51 young Americans, dressed in summer suits and light cotton dresses, formed a circle and sang the Ghanaian national anthem. Into a world cleaved by the Cold War, the Peace Corps was born.

Thirty-eight years later, more than 6,500 Peace Corps volunteers are at work. The Cold War is history; the Peace Corps is not, except in more than 50 books. Volunteers publish memoirs. "Official histories" tout success, while political tracts question the agency's altruism. But now Elizabeth Cobbs Hoffman, professor of American Foreign Relations at San Diego State University, has written a thoughtful history setting the Peace Corps in its place and time.

Like many a Peace Corps volunteer, Hoffman takes a while to feel comfortable with her task. Reading her opening chapters about the agency's creation reminded me of slogging through ankle-deep mud during my own Peace Corps service (Costa Rica—1985-87). Yet once she follows volunteers into the field, her story grows in the telling. The Peace Corps has had a quixotic journey. Its initial promise quickly got a cold shower of real life in the developing world. During the Vietnam War, as young people questioned their gov-

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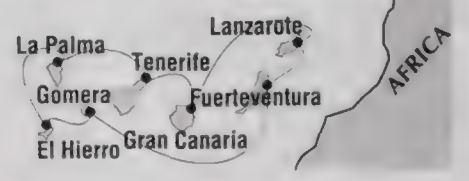

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ernment's foreign policy, the Peace Corps's applications plummeted and its rolls were cut in half. The agency drifted through the 1970s, seeming the rusted relic of a lost decade. Then, just as the Reagan Administration was about to axe the Peace Corps, gung-ho director Loret Miller Ruppe saved it and at the same time restored volunteers' self-respect.

Citing both critics and supporters through the years, Hoffman details many bureaucratic boondoggles yet eulogizes volunteers. In "The Hero's Adventure," she tells the story of Larry Radley. This single chapter is the truest, most moving thing I have ever read about Peace Corps service. Recruited in 1961, Radley left Chicago filled with "heroic images drawn from American popular culture." We follow him through an arduous training. We read his letters home from a cliff-side village in Colombia—"Killed a little cobra [sic] last night!" We feel his isolation—"Sometimes I just hide in my room so I don't have to go out in the street and say hello to everyone." We rise with his hopes, and fall with his plane into a mountainside where Radley and a fellow volunteer were the first, in 1962, to die in service.

Hoffman recognizes that the Peace Corps is the sum of its parts. It's an energetic teacher in a Senegalese classroom. It's also the idle carpenters I knew who quipped that the Peace Corps is "the toughest job you'll never have." Hoffman delves into memos, memoirs, even in-country newsletters, and comes up with nagging questions. Have 147,655 volunteers made a difference to anyone but themselves? Isn't an American English teacher in Bolivia the height of paternalism? If Hoffman offers no conclusions, it's because there are none.

Through all its sweat and struggle, the Peace Corps remains more spirit than substance, and Hoffman captures that spirit beautifully.

Bruce Watson writes from Massachusetts.

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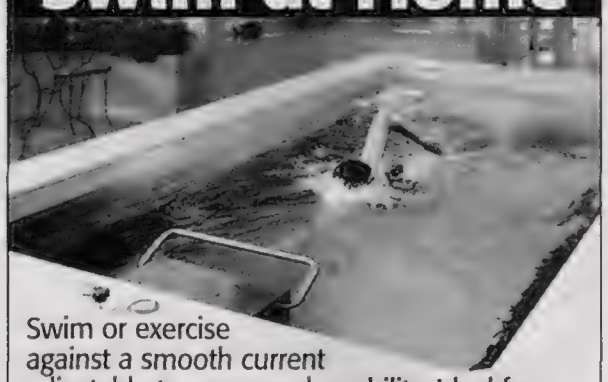

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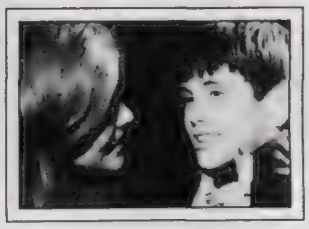

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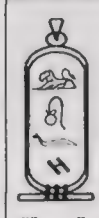

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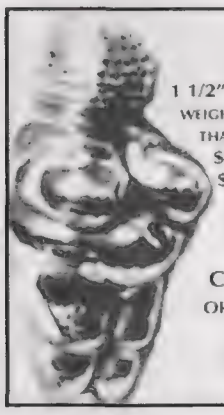

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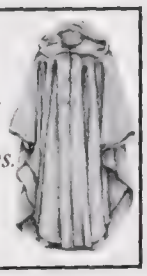

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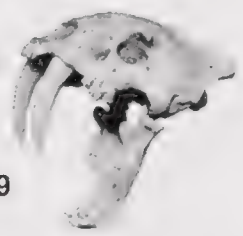

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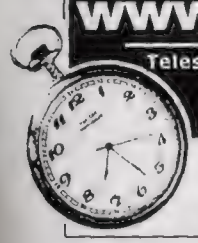

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Teller of Tales: The Life of Arthur Conan Doyle

Daniel Stashower

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MENTION ARTHUR CONAN DOYLE AND Sherlock Holmes pops to mind, which is *not* the way Conan Doyle wished to be known. Nor does he need to be, for Conan Doyle threw himself into life with a vengeance, and though he remains inexorably linked to his famous pipe-smoking detective with the deerstalker hat, there are countless other ways to remember this teller of tales, so richly portrayed in Daniel Stashower's biography. Stashower, himself an accomplished practitioner of the mystery novel whose titles include *The Adventure of the Ectoplasmic Man* and *Elephants in the Distance,* is admirably suited to the task.

In 1881, at 22, Conan Doyle received a Master of Surgery from the University of Edinburgh, having sold stories on the side to help pay his tuition. He had interrupted his studies for a stint as ship's surgeon aboard a whaling vessel. Following graduation, he served as ship's doctor on a freighter that steamed between Liverpool and West Africa. In 1891, he abandoned his medical career to "give himself over entirely to his writing," but never lost his taste for adventure, talking his way, at age 40, to the front as an army doctor in the Boer War. Back home, the burly, affable author successfully championed two men he believed to be wrongly imprisoned, dabbled less successfully in politics, and became a world-class sportsman. He predicted the Channel Tunnel and space travel, and was an early owner of a motorcar. "While demonstrating the new car for his mother," writes Stashower with subdued wit, "Conan Doyle managed to slam into a cartload of turnips. The Ma'am [Conan Doyle's name for the mother he dearly loved], unperturbed by the sudden shower of vegetables, continued with her knitting."

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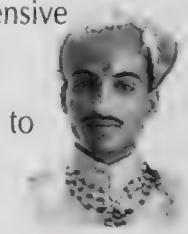

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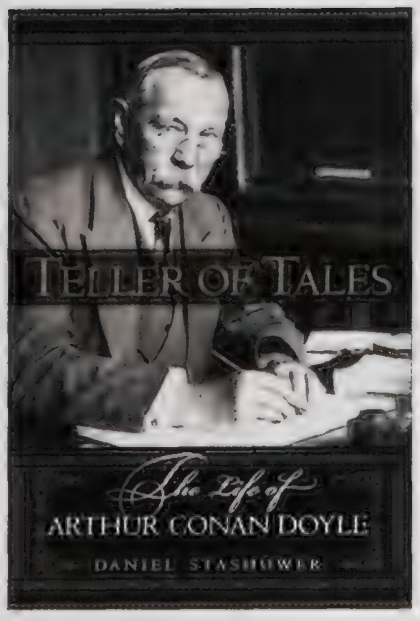

Knighted in 1902 by King Edward VII—an avid Sherlock Holmes fan—Sir Arthur had also set about traveling the world, climbing the Great Pyramid of Giza, which he deemed "an uncomfortable and useless feat," and allowing himself to be locked into a seven-by-four-foot cell at Sing Sing Prison to see what it felt like. He later joked that it was "the only chance I had to get away from the reporters."

Through it all, he wrote—historical novels, plays, science fiction, war chronicles, mysteries—sometimes, Stashower reports, "turning out an average of three thousand words a day" and "on one occasion, recording a mind-boggling ten thousand words in a single day." In 1886, Conan Doyle had churned out the first Sherlock Holmes story, *A Study in Scarlet*, in less than two months.

"He had no way of knowing," writes Stashower of that first book, " . . . that he had created one of the most indelible characters of modern fiction." An admitted Holmes fan since childhood, Stashower considers Sherlock Holmes "a cultural archetype—like Robin Hood, Romeo and Juliet, or the Three Musketeers. Children in Zaire and Tibet," he claims, "recognize his image as easily as that of Santa Claus or Mickey Mouse."

Though Sherlockians, as Holmes aficionados call themselves, never tire of their hawk-nosed detective, Conan Doyle quickly wearied of his creation. Having completed five of the six Sherlock Holmes stories he had promised *The Strand* magazine, he announced his intention "of slaying Holmes in the sixth and winding him up for good and all."

The Ma'am, horrified, pleaded for Holmes' life, and as was so often the case, Conan Doyle could not say no to his mother—though ultimately he did kill the detective. In *The Final Problem*, which was published in 1893, Holmes and the villainous Professor Moriarty plunged to their apparent deaths in a Swiss waterfall. Conan Doyle, Stashower reports, "made a laconic notation in his diary—'Killed Holmes'—and moved on to other matters."

But it was not that easy. Conan Doyle's readers were outraged by Holmes' death. Twenty thousand fans canceled their subscriptions to *The Strand*. Londoners wore black mourning bands. But Sir Arthur remained unmoved: " . . . I hold that it was not murder, but justifiable homicide in self-defence, since, if I had not killed him, he would certainly have killed me."

Although he did bring Holmes back in *The Hound of the Baskervilles* in 1901, "Conan Doyle did not want to be saddled with the responsibilities of a fully resurrected Sherlock Holmes." *The Hound of the Baskervilles*, Stashower explains, "was to be presented as a previously untold tale . . . that predated the detective's fatal encounter with Professor Moriarty." With the return of the revered detective, dead or not, the magazine's circulation shot up by 30,000 copies.

While researching his sweeping biography, Stashower often found that people were puzzled by his interest in Conan Doyle. "The response is invariably polite," he writes, "but it generally carries a quiet note of sympathy . . . 'Conan Doyle? Well, Sherlock Holmes was brilliant, but Doyle went a bit potty at the end, didn't he? Fairies, ghosts and that.'"

Indeed, as Stashower reports, "toward the end of his life, Conan Doyle came to believe that communication with dead souls was possible," a fact that over time alienated both friends and fans. "Many found it difficult to reconcile that the creator of Sherlock Holmes, the 'perfect reasoning and observing machine,' could have given himself so wholly to a cause that appeared to defy logic. A man who espoused such ideas, it seemed, could not be taken seriously as a writer."

Conan Doyle devised an ingenious way of dealing with such critics. Within days of a well-known skeptic's demise, Sir Arthur would report that the dead soul—including such notables as Charles Dickens and Joseph Conrad—had contacted him from the "other side," apologizing for doubting him and assuring Doyle that he'd been right all along. "If the living community of writers occasionally shunned him," writes Stashower, "the dead ones appeared to welcome Conan Doyle with open arms."

Stashower considers Holmes "a cultural archetype–like Robin Hood, Romeo and Juliet, or the Three Musketeers."

Though aware that to many he had become a laughingstock, Conan Doyle held his belief in spiritualism to the end. His conviction brought him "solace in the face of devastating loss [the deaths of his mother, son, brother and nephew]," writes Stashower, and he "felt he must share it with others. The task would absorb him for the rest of his life. If this makes him a madman, so be it."

Madman, perhaps. Fascinating and complicated man, without doubt.

Daniel Stashower's page-turning biography portrays the many sides of this complex storyteller in such incredible detail that one wonders if Sir Arthur was feeding him bits of information from the other side.

Emily d'Aulaire is based in Connecticut.

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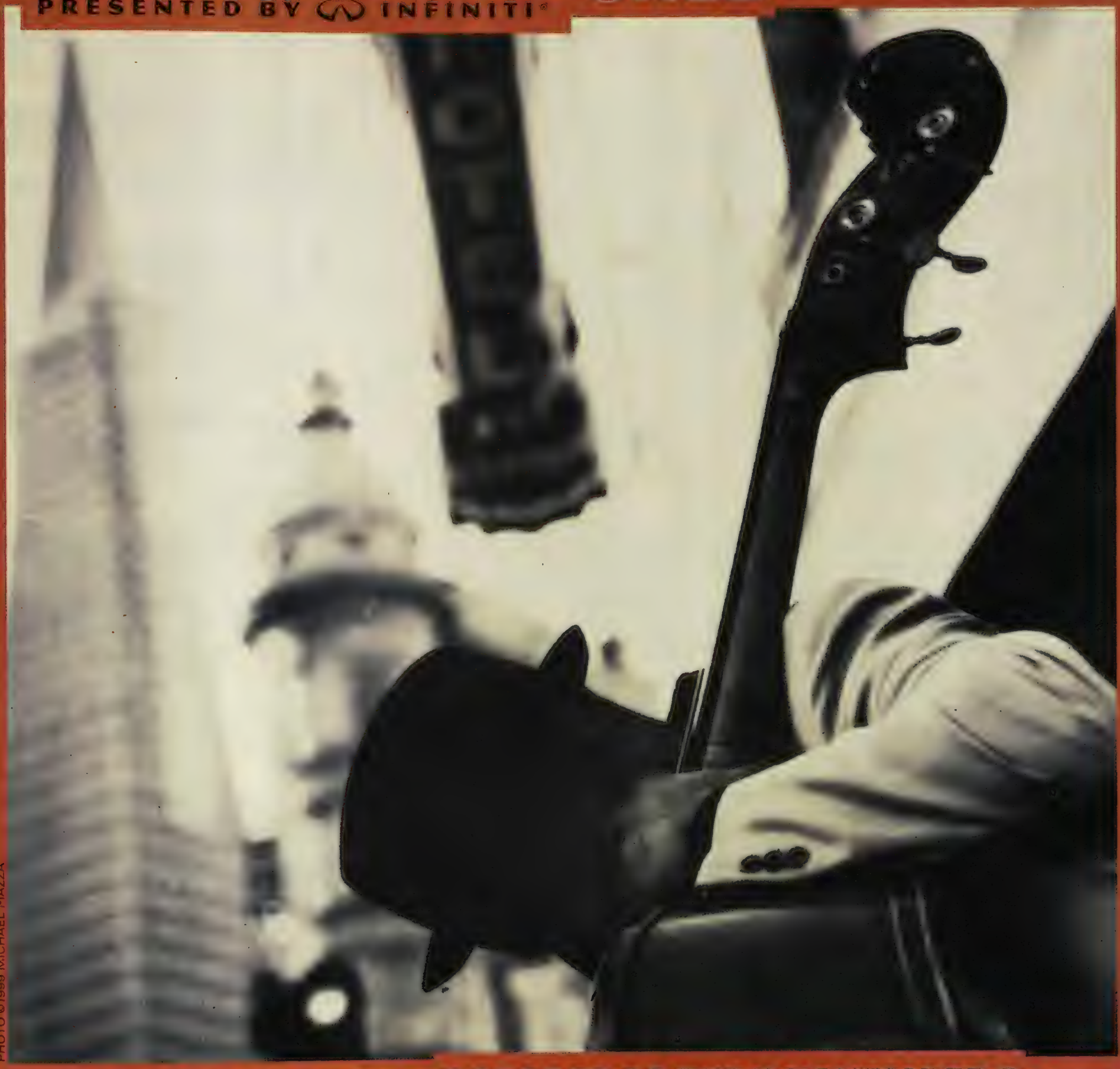

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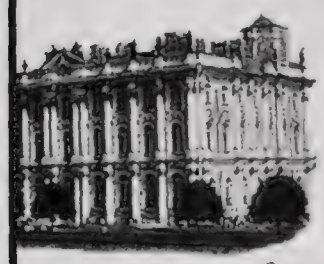

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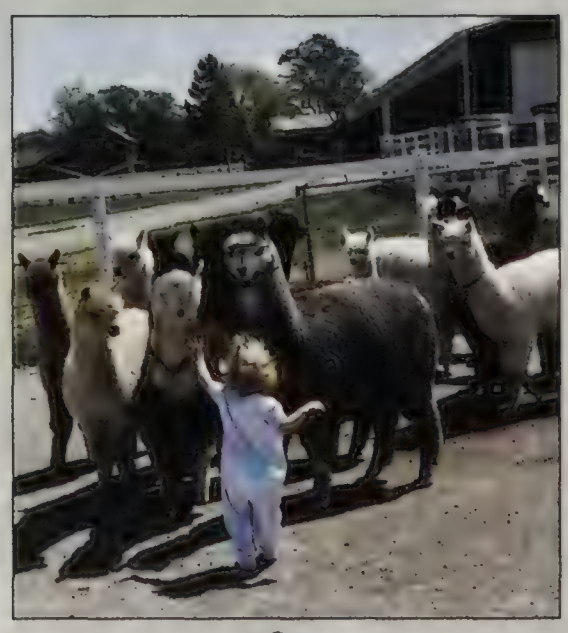

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THE LAST PAGE

What's One Bad Fig in A Bag of Nice Fruit?

BY BERNARD JACKS

THE OTHER DAY I OPENED MY monthly cable TV bill and found out the company is raising my rate and adding a new channel to the package. It's called the Dust Channel. I'm not upset because I know from firsthand experience that cable companies are by no means the first businesses to charge customers for something they don't want.

In 1958, I went to work at Louie's Appetizing Store in my neighborhood. Louie was my brother's father-in-law, and over the years every college student in our family had worked at his place to help pay tuition. Now it was my turn.

Reporting to the store on my first day, I saw customers jamming the display cases served by six countermen. Another man was busy at the barrels of pickles and sauerkraut and the crates of candies and fruits. The air was filled with the scent of garlic and the sounds of retail hubbub: ka-chinging cash registers, customers calling out their orders, and shouts from behind the counter, "What else besides that?" There was sawdust on the floor and a huge sign on the wall: "Louie's—The World's Largest Retailer of Deli Specialities!" As I stood there staring at the five-gallon jars of olives and red peppers lining the walls, I saw Louie—Lou, to the family—come out of the back wearing an apron.

We chatted briefly, and then he assigned me to my station. The man in charge, Mel, gave me some advice: "Always put an extra ounce or two of kraut in the container when you weigh it. You sell more that way. Try to get rid of the older pickles first. If they say, 'Give me a nice pickle,' answer, 'They're all nice.'"

"The customers figure it just fell in," Mel said. "They throw it away and forget about it."

Then Mel gestured toward a shelf under the counter where 30 or so waxy bags were stacked. "Try to use up those bags during the day," he whispered to me.

"Why those bags?" I asked.

"We got half a crate of rotten figs in the back," Mel whispered. "Whenever this happens, we hide one bad fig in each of those bags and then use a bag to make up whatever a customer is buying. When they get home, they have a pound of nice fruit except for the bad fig. They figure it just fell in. They throw it away and forget about it."

"You put a rotten fig in each bag?"

"Right."

"Does Lou know about this?"

"It's his store, ask him," Mel said mildly, handing me an apron.

Within minutes, I had sold a rotten fig to some unsuspecting woman. It was to be the first of many.

I never confronted Lou about the figs—after all, I was a coconspirator—but as we were closing one night I did ask him about the "World's Largest" sign. He smiled and shared his marketing philosophy with me. "When the world's largest retailer of deli specialties comes in and tells me to take the sign down," he explained, "I'll take it down." With that he sent his regards to my folks and went to turn out the lights.

I paid my new cable TV bill, of course. By now I have long since learned what people mean when they say business is business. If I want the service, then I'm stuck with the Dust Channel. Hey—at least I know what I'm getting for my money.

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